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[ILLUSTRATED.]

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Electric Lighting and Aerial Wires.

ADDRESS OF C. C. HASKINS, CITY ELECTRIC INSPECTOR, CHICAGO, AT THE SEVENTEENTH ANNIVERSARY OF THE FIRE UNDERWRITERS' ASSOCIATION OF THE NORTHWEST, HELD IN CHICAGO, ILL., SEPTEMBER 8 AND 9, 1886.

Gentlemen of the Fire Underwriters' Association of the Northwest:

There are certain terms used in electrical work which, for the better understanding of what is to follow, should be explained.

Electricity is a force, not a substance. In this respect it is like heat, light, or magnetism, and may be converted into either, as any one of these is reconvertible into any other.

Certain metals conduct heat more readily than others. Those metals or substances which conduct or carry heat more readily than others are said to be better conductors. These facts also apply to conveyers of electrical currents. Those which are the best conductors have the least resistance, and *vice versa*. Those which the most perfectly obstruct the current are those which have the highest resistance. When we find a material or substance which is a very positively bad conductor, we call it an insulator. Dry air, dry wood, glass, porcelain, resinous gums, etc., these are all insulators.

The metals, copper and silver first, are good conductors, while iron, having nearly seven times the resistance of either of these, would require to be seven times the size of a copper wire to offer the same carrying capacity to a current. That is, a copper wire one-seventh of an inch in diameter has a carrying capacity about equal to an iron wire approximating one inch in diameter.

If we overload either wire, that is, send more current through it than its capacity or size warrants, the flow is obstructed, and a portion of the current is converted into heat.

Heat, then, is a result of resistance in a conductor, and it is to resistance—to this conversion of electricity into heat and light by resistance—to the work of overcoming an obstruction—that we are indebted for the electric lights of to-day.

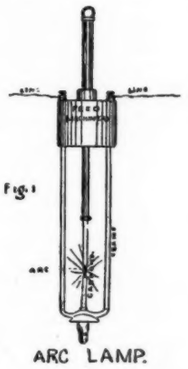
There are two general divisions of electric lights known to the trade and to the public as well as arc and incandescent.

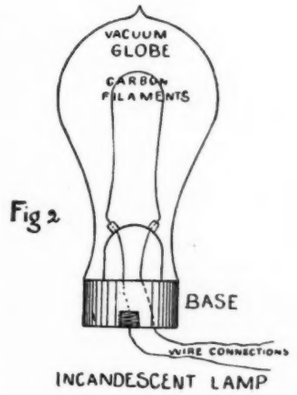
The first of these is named from its being the result of an electric arc, a flame of electricity. (Fig. 1.)

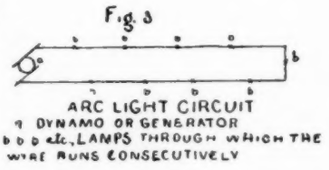
This arc is caused by the obstruction which a space of dry air offers to the passage of a current. Its carrying capacity is so interior that the resistance transforms the current into light and heat. Two carbons, one on either side of the arc, are slowly consumed.

The incandescent light, which, as its name indicates, is not a conflagration, but a white, glowing heat, is the result, as in the former case, of resistance. The little wire-like loop is carbon. The space which the globe encloses is nearly enough so to be called a vacuum—the air is virtually exhausted, and there being no air—no oxygen—there can be no combustion. (Fig. 2.)

Let us first examine an arc light circuit. The method of producing the current is virtually the same for both this and the incandescent system—the dynamo. This dynamo, or generator, sends a current out to line; it comes to an obstruction at a lamp; it jumps the obstruction, passes on to the next, and so successively at each lamp, and arrives home much the worse for wear. The dynamo is, however, constantly supplying a current,



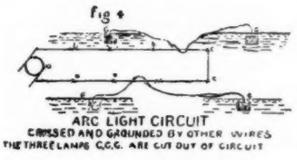


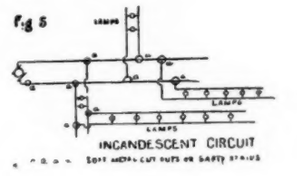


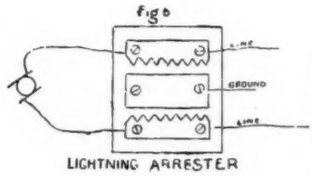
and the waste—or conversion rather, for nothing in nature is ever wasted—is constantly made good. (Fig 3).

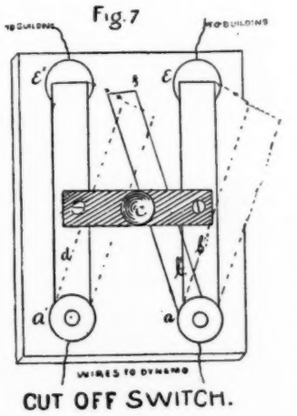
Now, understand, this is the condition and performance of the current when the line is in proper order and form—that is, when the wire is perfectly insulated, separated by some one of those poor conductors, air, glass, porcelan, etc., from contact with anything which leads to the ground, or some other line. The wire must be complete; a metallic path from the generator out through all the lamps and back to the generator. It must be of sufficient size to carry the current used without sensibly heating through the resistance it offers to the current—that is, it must be large enough. If it gets hot it is too small. Every portion of the line must be of sufficient capacity. Where the wire enters the lamp, where the ends of wire have been put together, at a joint, there must be full carrying capacity to prevent heating.

Now, a line in which these conditions are









fulfilled perfectly—that is, a line which is:

First, thoroughly insulated from the earth and from possible contacts through which the current may escape, and get back to the generator by some cross-cut or short road, and

Second, which has a wire of capacity sufficient to carry the necessary current without heating. Such an electric light plant is thoroughly and perfectly safe while it remains in that condition.

To enumerate the multitude of faults which may occur in a line to render it dangerous, would require much more time than the association would accord the subject.

The two wires which run from the dynamo are often quite near each other for some distance, before they separate to go to line. These should not be less than ten or twelve inches apart. The nearer together they are, of course the greater the possibility of either getting these crossed, or getting them connected by some conductor. I have known a fireman to hang his wet shirt on two wires to dry—a trick which cost him a new shirt. The resistance of a wet cloth will develop heat as well as any other resistance. The wire in this case was insulated—but fire-proof insulation is not water-proof, and water proof insulation is not fire-proof, except where the insulation is made so by covering with metal.

Gas men, plumbers, carpenters and engineers, while not wilfully mischievous, often do great harm after a plant is established, by running pipes, rods, or other fixtures, for pumps, soda fountains, gas, sewerage, water or steam, in close proximity to wires. They don't know any better, and they cannot be blamed, but must be watched.

A short time since I found one of these large wires within about half an inch of a gas pipe. Normally it was safe. The space between the wire and the pipe was an excellent place in which to put an iron chisel, screw-driver, or hammer. This would be quite natural. A wet towel would accomplish much the same result—create a ground connection, or what we technically call a ground.

Wires have sometimes been fastened to the plastered wall by iron staples. These may or may not be safe, temporarily, but it is not rare for the lathing in recent structures to be of wire, connected indirectly or directly to ground.

Wires running through damp places, as cellars, basements, etc., unless carefully guarded, are liable to form contact through dampness, with water and gas pipes, either of which goes to ground.

Outside wires are full of expedients for getting a plant into trouble. Where they cross buildings, if there are other wires, either electrical or guy or stay wires, contact with these may mean a heavy loss in a block half a mile away. If the wire is a telegraph, telephone, police, or fire wire, its capacity for carrying is not equal to that of the electric light wire. If the current is deflected from its proper wire to the central office of the company whose wire is thus crossed, circumstances alone will decide what damage is to be paid for.

Some three years ago a small loss occurred which may serve to illustrate this phase of danger.

A temporary line was run from a plant in the same block, to furnish light for an evening entertainment. The wire was not insulated properly, and during the existence of this additional circuit a rain storm wetted the surface where the electric light wire rested, and formed a road for the current to a telephone wire. The telephone wire bore the indignity well enough until it reached the fine wire cable in the exchange. There it would withstand the insult no longer, and it burst into fire. The wire was too small to carry the current thrust upon it, and diminished size, as we have seen, means increased resistance, and resistance means heat.

Water, then, may be made an element for

producing fire. Why? Because it is a conductor of electricity, while wood, wool, silk, etc., are insulators when dry. Hence a wet wall, a damp board, even a dishcloth, might, under favorable circumstances, cause a severe loss to an insurance company.

So, too, a wire on the face of a building, is liable to come in contact with metal cornices, columns, posts, frames, etc., and I consider the long loops of wire which lead from the building to an outside lamp, which is suspended from a rope, particularly dangerous.

These hangings are hazardous to both persons and property. The pulley rope, by which the lamp is lowered and raised, being no essential part of the light proper, is never looked after, as a rule, until the weather has perhaps materially reduced its strength, or it has given away. Some half a dozen or so of these have fallen in Chicago through the neglect of this rope.

A still worse feature in this form of hanging, is the almost constant certainty of grounds where these wires flap against rods, frames, etc., and are wrapped up in the awning, which latter may be wet at any time.

A remedy for this form of danger is found in a hanger manufactured by the Electrical Supply Company, which costs a mere trifle more than a plain rod. There is no reason why the underwriters should not demand the use of some such expedient as an additional element of safety.

I have frequently referred to the danger arising from a ground connection.

Franklin, among other quaint things, said: "Take care of the pennies and the pounds will take care of themselves."

One penny is but a small amount for either good or evil.

One ground on a line can do no positive harm; and if we can keep the first ground at a proper distance, the second will take care of itself.

I have said that the current which any conductor will carry is proportioned to its capacity, the same as a water pipe; and if we have two conductors, one twice as large as the other, leading from the same source, one of these will carry twice as much as the other. The ratio is in proportion to the capacity. (Fig. 4.)

The current from the dynamo starts out on the line, and finds on its way a ground connection, say, one-quarter of the way round. Three-quarters of the way round there is a similar ground. In this case a certain amount of current is cut off and goes to earth at each of these points, and the lamps in the farther half of the circuit are deprived of just so much current energy. The amount which will escape at these two points will be in proportion to the carrying capacity. If the grounds are good, they will cut out the lamps beyond them entirely. If the line is a better conductor than the ground more current will traverse the wire than waste at the leaks. If one of these happened to be a telephone wire, a fire might be the result: and if one of them happened to be an underwriter, a funeral might be in order. But if either of these occurred, and there were no other grounds on the line, there would be no work for either the adjuster or the coroner.

The incandescent circuit—and by circuit we mean the wires which carry a current—must also be kept free from contact with the earth.

The current used by the incandescent systems is less fierce than that used by the arc systems. We say of steam at 90 pounds that its pressure is greater than at 80 pounds. So of electricity—we have what may be understood as high and low pressure. The highest pressure we can create is shown in that which is generated by a frictional machine, and comes nearest to that of nature. The lowest pressure is that which we accumulate by means of batteries, such as are used in telegraphy. We have quantity also, which is but another name for a result of low resistance.

Now the incandescent system uses a current of such low pressure that it is far more easily controlled and kept in the straight and narrow path than is wicked partner, the arc current. The wires, too, are differently placed. From either side of the dynamo the two wires are carried parallel out to the end of the circuit—say, the upper floor of the building. They are not joined together at that point, but left open. (Fig. 5.)

Now from a given point on these, say the first floor, a wire is carried at right angles from each of the mains down the halls on that floor. Opposite each room we attach a wire to each of these secondary wires, and run them parallel to the end of the room.

In all this wiring we have made no connection between the ends of the wires. All these ends are open. Anywhere we like, governed by certain rules depending upon the matter of resistance again, we can put our lamps in like rounds of a ladder. The branches leading into the room may be connected together by a dozen lamps, and the current has no way to get from one wire to the other, except to go over these little bridges, these lamps.

There are modifications of this method, but they do not affect the question from our standpoint.

You will naturally ask what safeguard there is in a system so placed. I answer this: At every point where there is a branch wire, at the junction, is placed a safety strip, which protects the wire from that point to the last branch from the dynamo.

The action of the safety strip is this: Being placed in the direct path of the current, it carries all which crosses that part of the circuit. Its carrying capacity is less than that of the wire, for it is made of a metal of higher resistance, and it melts at a lower temperature. Whenever a screw-driver or a nail is made to connect the two wires leading to the two sides of the generator, the resistance is reduced at that point. More current crosses at that point than is useful. The soft metal melts and cuts the line in two. A leak from a water pipe may form such a contact, and, before the building would be endangered, the increased flow of current would open the line, put out the lights on that branch, and cut off the dangerous current.

The soft or safety strip is graduated for the current it is intended to carry. Usually these are numbered for the number of lights they are designed to protect. The incandescent plant should not be allowed to run without safety strips under any circumstances. It is the custom of some companies to put the safety strip in the socket of the lamp. This is on the principle of fun for the boys, but death to the frogs. The lamp may be saved in case of excess of current, but the building may burn.

It is all well enough to place the safety strip in the socket of the lamp, but the strip at the junction should not be omitted on any account.

Care should be taken to see that the wires do not run in such a manner or through such places as to allow of accumulations of dirt, lint, inflammable dust, etc.

I once found in part of an incandescent circuit a large accumulation of material, just such as a rat would select for a nest, in contact with the wires, and in an arc light circuit, where the two wires had dropped behind a store sign, I found a colony of sparrows.

Were I asked point-blank what faults shall we look for in a plant, I should hardly know what to answer. There are so many wrong ways of doing, these are so different, hardly occurring twice consecutively, that it is a matter of almost utter impossibility to answer such a question directly.

Two questions have been asked, relative to the proper placing of a dynamo, which I will answer here.

Outside the question of insulation a dynamo may be looked upon as we would look at any other rapidly revolving machinery. It should be as thoroughly insulated as any portion of the line, and must be considered as part of the line. It should be placed on a foundation selected, and arranged so as not to endanger the building by vibration. The fire hazard is not increased by the dynamo when this is properly protected by insulation. It has been sometimes suggested that an electric light system served to fill the air, saturated it so to speak, with electricity, and thus endangered the building. As long as a line is insulated properly so long the current will remain on the wire. With a ground elsewhere on the line a second leak might occur in a damp, very damp room, through the moist air to ground; but with a well-insulated line this could not occur. With dry air such a saturation would be impossible. Magnetism is always present in a room where a dynamo is, but this force is harmless to persons and insured property. It is, however, ruinous to good watches, the steel parts of which absorb and retain magnetism.

Some other questions, asking specific answers, have been propounded, which, without repeating, I will endeavor to elucidate.

Where a line is of the central plant variety, by which name we designate a plant running lights for rentals from sundry parties, the wire is often quite long, and consequently exposed to atmospheric electric changes which might possibly overcharge the wire. It is hardly probable that any result would occur other than the destruction of the dynamo. For the protection of these machines it is well to put in what is termed a lightning arrester (Fig. 6) which will carry off the excess of current in case of sub-charging of the line from the atmosphere.

There have been many forms of arresters made, but none are thoroughly competent and reliable. The commonest form is made of three brass plates with connections on the two outside ones, to the generator in one direction and to the line in the other. The middle plate is connected direct to ground. The saw teeth are, by an electrical law, more competent for discharging a current than a plane surface would be. The objections to this form are that a heavy discharge may create an arc which the normal current will afterward maintain, or the teeth may be welded to the ground plate by the discharge. These faults are easily remedied, however, by stopping the dynamo, and as the arrester is in the room close to the dynamo the trouble is manifested immediately and readily cured. Mr. E. A. Sperry is the inventor of one of these arresters, which is claimed to act promptly and perfectly without these objectionable features.

I have never heard of any injury to person or property from such causes, but the placing of such lightning catchers effectually protects from possible discharges of lightning. The current generated by the dynamo will not leave the wire except through a ground. The current which is created in nature is on its travels, either from earth to cloud, from cloud to earth, or from one cloud to another; so that with all the other routes open to it, it is hardly reasonable to expect it to single out a copper wire on its way to the heavens or into the ground.

As a matter of confidence to the firemen, on such long circuits, it is not a bad idea to require placed at each building or block where the wires enter a cut-off switch (Fig. 7), which, being turned, completely cuts off the current from the locality or single structure; but even this, if wires are properly placed, is hardly necessary.

The cut-off switch may be of any form which will accomplish the complete separation of the building to be protected from the line. It differs essentially from a cut-out switch. The latter merely puts out the lights, but does not separate from the generator.

In the cut shown the wires come from either side of the dynamo to the binding posts a a^1. b b^1 are brass, and virtually one piece; c is of wood, hard rubber, or some other insulator, by which the switch is moved; d is another brass strip; e e^1 are two brass studs to which the wires running into the building are connected. As the switch stands in its normal position the current enters at a, passes through b e, thence through the building to e^1 d a^1 and back to generator. Now, when we push the switch over we open the contacts at e and e^1, but close the circuit at f, so that the current from the dynamo cannot get beyond that point.

To my mind there is but one sovereign panacea which can cure the ills of the electric light business. No plant should be permitted to run until a thorough inspection has been made by a competent electrician, with power to enforce his suggestions. And I believe it would be money in the treasuries of the fire insurance companies to be at the expense of such inspection, dividing this *pro rata* among the benefited companies, or on some modification of such a plan. I have not given the subject thought beyond this crude suggestion.

In my opinion no wire for electrical purposes should be allowed above ground. While these are permitted to swing in the air, from poles and housetops, contact with other wires is almost certain, and where these are telephone, telegraph, or other grounded lines, the result if one such is crossed with an electric light wire, might be disastrous. With these in the ground the wind and weather can have no effect, and such a thing as a cross would be next to an impossibility.

In conclusion, it seems to me, if I may be allowed to express an opinion, that the insurance companies are quite the proper parties to urge both these points, and they certainly can, if it is deemed expedient, control the former. The experience in Chicago is certainly well worth attention and consideration.

Progress of Mechanical Science.*

The recent enlargement of the scope of this section to include all branches of engineering, and the increasing interest manifested in its meetings, warrant my making some remarks as to the true objects of the section, and the means of increasing its usefulness in the future.

In marked contrast with the past, the present age is one of pronounced material development. Formerly the brightest and most gifted men devoted themselves to religion, philosophy, politics, exploration, art; but for the past hundred years the attention of the leading men of the civilized world has been directed to increasing and cheapening those products which minister to the daily life and comfort of man. Farmers, mechanics and laborers live now more comfortably than did the middle classes of feudal times; the duration of human life has been materially lengthened, and all portions of society recognize the importance of further progress, and the advantage of organization and invention in securing it.

This era of material progress may be said to have commenced with the final perfecting of the steam engine, which, together with the various attendant machines, takes the place of hand and animal labor, and which has increased and cheapened the production of the necessaries and luxuries of life; and it has pushed the inventor and the engineer to the front rank in modern society. It may be useful to point out the absolute necessity of verbal and written intercourse between investigators and inventors, that the speculation and curiosity of the former may ripen into the effective invention of the latter. Nothing is more remarkable than the multitude of minds and facts which are required for the perfecting of even a simple machine, nor how little the last man may need to add to complete the invention. Facts and natural laws, known for years as curiosities, are taken up by some inventor, who fails in the attempt to render them of practical use; then a second genius lays hold and, profiting by the mistakes of the first, produces, at great cost, a working machine. Then comes the successful man, who works out the final practical design, and, whether making or losing a fortune, he yet permanently benefits mankind.

The faculties of invention and discovery are generally separate. One set of men observe facts, and deduce laws therefrom; and another set endeavor to turn the results of this observation and deduction to practical account in the production of labor-saving appliances. This section should be the place where these men may meet one an-

*Abstract of an address before the section of mechanical science of the American Association for the Advancement of Science at Buffalo, August 19 1886 by O Chanute, Esq., Kansas City, vice-president of the section.

other, and profit by the interchange of ideas. Many of the men whom I see before me are devoting their lives to the study of nature, with no desire to make money out of it, but simply to increase human knowledge; and some of their discoveries will eventually be put into practical shapes for the use and convenience of man. History proves, too, that the scientific observers have the safer and happier part. Their success may not be so dazzling as that of some great inventors, but they do not have to bear such bitter trials and disappointments. To deduce natural laws requires mental accuracy in observing and reasoning; to make them useful in doing the world's work requires imagination and ingenuity. Sometimes long years must pass, and generation after generation of inventors wear their lives out, before a needed machine becomes an accomplished success. Evidently, then, the greater the number of minds that can be brought to bear upon a particular problem, the greater is the chance of early success. I believe that it is the particular province of this section of the association to bring these two classes of minds together, and to promote their intercourse, that the discoverer may learn in what direction fresh information is needed, and that the inventor may be advised as to what is already known.

The well-worn history of the steam-engine gives us an instance of an invention which did not spring full-grown from the brain of the inventor. History informs us that it commenced to exist two thousand years ago, in the eolipile of Hero of Alexandria. His treatise remained hidden until translated and printed in 1547; and then Branca, the Italian architect, constructed one for pounding drugs. Hero's book ran through eight editions in different languages, and attracted the attention of a French inventor, who tried vainly to raise water by steam pressure. Then came the Marquis of Worcester, who died a disappointed man, after spending $250,000. Then de Morland tried using steam in cylinders, instead of in contact with the water; Papin built a steamboat, only to have it seized and destroyed while on its way to England, and he, too, died broken-hearted and poor; Savery went back to using the steam directly in contact with water; and finally Newcomen built an engine that worked; and between 1705 and 1758 quite a number were erected. These engines had a duty of only 5 500,000 foot-pounds per pound of coal, the improvements of James Watt, an instrument maker, increasing the duty to 60,000,000.

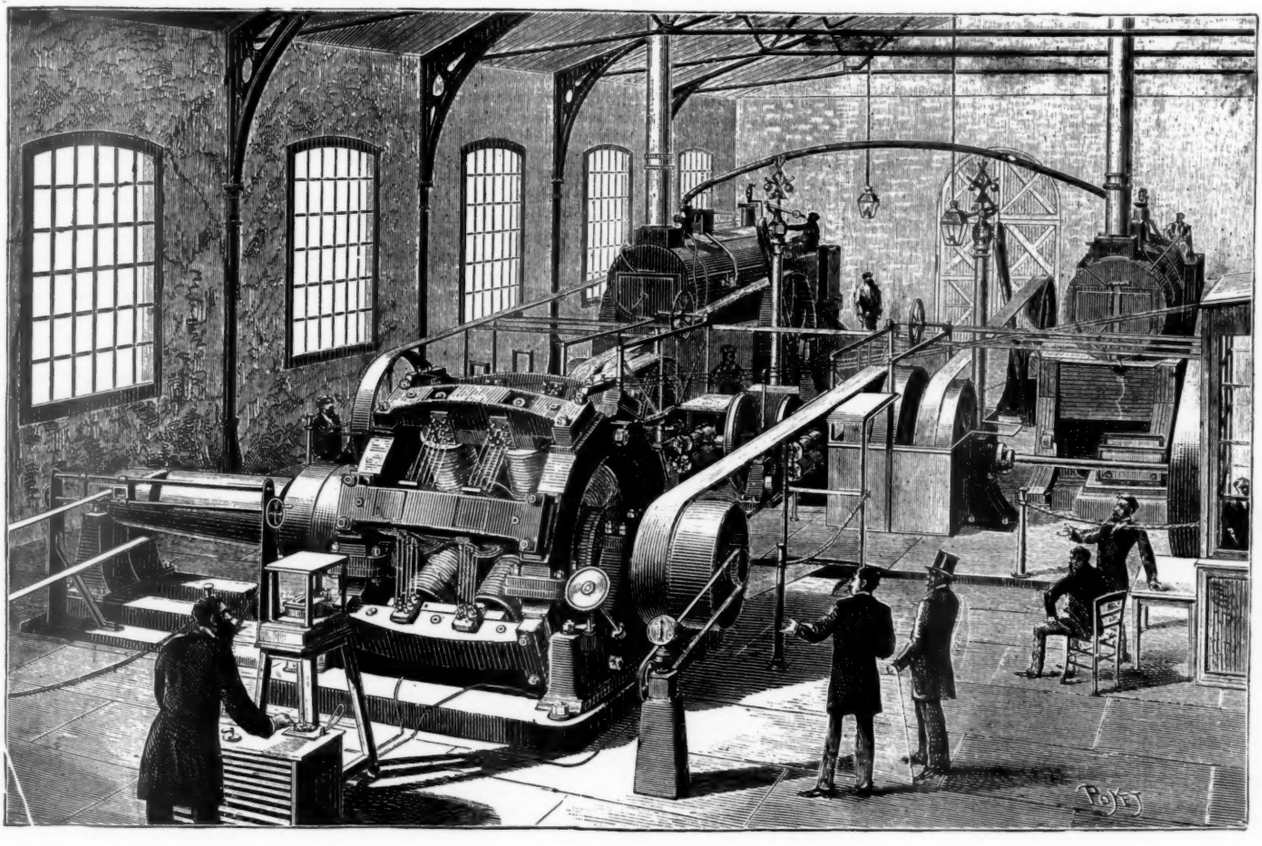
My object in giving this sketch is to call your attention, first, to the gradual evolution of an invention by the process of exclusion, by finding out what would not do; and second, the apparent chain of connection running for over a century, through several generations of inventors, each evidently profiting by the failures of his predecessors, to the extent, at least, of avoiding their repetition. Is it not evident that the earlier inventors would have accomplished greater results had they had a larger range of scientific experiments and advice; and that Watt triumphed because he had the whole faculty of the University of Glasgow at his back, to give him knowledge of natural principles, and information as to what had been done? So with other inventions: the steamboat was being developed from 1760 to 1807; the locomotive, from 1802 to 1829; the telegraph from 1729 to 1844; the sewing machine, with its two thousand patents, from 1790 to 1860; the reaping machine, for seventy-five years, and so on,—the last successful man adding generally but little to what had been done before. The rule is, that "the basis of success lay in a thorough acquaintance with what had been done before, and in setting about improvement in a thoroughly scientific way."

My own observation has acquainted me with the development of the ice-making machine. The economical production of cold by the combustion of fuel was a matter of theory when, in 1755, Professor Cullen experimented in Glasgow with "quick-lime and spirits of sal-ammoniac" as the best volatile substance for producing cold. His discoveries remained as laboratory experiments until Jacob Perkins, in 1834, obtained a partial success in producing ice by the evaporation of ether. Then came Professor Twining, of New Haven, Leslie, Valance, Harrison, Pontifex Seibe, Windhausen, Tellier, Carre, and Pictet, with more or less doubtful success. Up to 1869, the machine was in the experimental or unsuccessful stage. Then came an experimenter who deliberately read up the whole subject in a library, and made himself master of what patent-attorneys call "the state of the art," and of the scientific principles concerned, working, according to his own account, "harder than he ever had before in his life." He discarded the usual working fluids, and adopted anhydrous ammonia. After various struggles and successes, the machine was adapted to the difficulties of the case, and put in successful operation in 1874, since which time it has become of immense practical importance in warm climates, for making ice, cooling breweries, etc., though giving an efficiency of but seventy per cent. In 1877, another inventor set himself deliberately to improve the machine. He put a practical mechanic, a chemist, and a patent-attorney to work, and in 1878 built a machine, which, however, gave no improved results. He did not let the matter rest here, however, but persevered, and in 1880 built an entirely successful machine, which did the work for which seven thousand tons of ice had been required. So rapid has been the introduction of refrigerating machines, that there are now several hundred of various makes at work in the United States. They produce as much cold for each ton of coal consumed as would be obtained by the melting of twenty tons of ice, at which rate natural ice is worth only seventy-five to eighty cents per ton, or less than the usual cost of harvesting and storing it.

It may be well in this connection, to mention some inventions which are now, so to speak, "in the air;" of course we all recognize that the flying-machine belongs to this class, in one sense if not in another, and a paper upon it has been presented which may prove of interest to you. What is needed, however, is a sufficiently light motor, without which a flying-machine cannot be expected to succeed. Steam power, also, for agricultural work in its many forms, is not yet an accomplished fact; and we may mention one machine greatly needed—a cotton-picker. Then, too, there is the electric motor for street traffic, which needs further improvement; also the transmission of power over great distances, electric lighting, etc., etc.

The Transmission of Power Between Paris and Creil.

A great deal has been said about the experiments of M. Marcel-Deprez, but we have not until quite recently seen any authentic report. The Rothschilds some time since provided him with an unlimited credit to prosecute his researches at Creil, under the inspection of a commission of thirty-eight men of science. On July 23d the commission met to hear a report on the results at present obtained, drawn up at their request by M. Maurice Levy. The report was unanimously approved. It appears from it that it is possible now, with one generator and one receptor, to transport to a distance of about thirty-five miles a power capable of being used for industrial purposes of 52 horse-power, with a yield of 45 per cent., without exceeding a current of 10 amperes. When the amount of power absorbed by the apparatus used to facilitate the recent experiment, but not required in the applications to industrial purposes, is added, the yield will be nearly 50 per cent. The commission certifies that the machines now work regularly and continuously. The maximum electromotive force is 6,290 volts. Before the construction of the Marcel-Deprez apparatus, the maximum force did not exceed 2,000 volts. The report states that this high tension does not give rise to any danger, and that no accident has occurred during the past six months. The commission is of opinion that the transmitting wire may be left uncovered on poles, provided it be placed beyond the reach of the hand. It estimates at nearly £5,000 the probable cost of the transmission of 50 horse-power around a circular line of about seventy miles.



TRANSMISSION OF POWER BETWEEN PARIS AND CREIL—DYNAMO ROOM.

* * M. Marcel Deprez, the great French champion of the electrical transmission of power, has invented a new electric brake which Messrs. De Rothschild are at present testing at the Gare du Nord, Paris. The apparatus is based on the principle of the Solenoid. It may be simple, but it is rather heavy—from ten to 12 cwt.—and expensive, containing, as it does, 250 to 300 kilos of copper.

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We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity and those engaged in Electric Lighting on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

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The New England Telephone and Telegraph Company are extending their underground system, which runs from the central office on Pearl street, through Franklin street, to Washington street. Three-inch iron pipes were used, protected by brick laid in cement. The pipes were filled with 100-wire Patterson cables. From the intersection of Arch and Franklin streets cables will be laid through the city by way of Tremont street as far as Pynchon street. At the present time the Berkeley street branch is being constructed. The conduit, 1,500 feet in length, is to be rectangular in shape, of creosoted wood and with six ducts, each of which will contain a 100-wire cable. The overhead wires now on the Institute of Technology and in Copley square will be removed.

At the main office in Pearl street there is to be an extension of the multiple switchboard, to accommodate additional subscribers. Two sections will be added. A new trunk-line board of improved design will replace the boards now in use. The Tremont street branch has been recently equipped with a multiple switchboard, to accommodate 400 additional subscribers. In the Boston division, which includes the central office and twenty-one branches, there is a gradual and healthy growth, which promises well for the future of the company.

ELECTRIC LIGHT ON THE NORTH-BRITISH RAILWAY.

Many complaints have been heard of late in England concerning the management of the North-British Railway in so illy lighting their cars while passing as they do through long tunnels. Before electrical lighting was known to be a success the public patiently bore with the inconvenience, but now they have concluded, and rightly be it said, that there is no longer any reason for confining the lighting of such trains to a few smuffy and ill-smelling lamps. Compelled to take some action in the matter; the company hit upon gas as a means of quieting the grumbling. It only increased it, however, for whilst it gave more light than the lamps, it rendered the atmosphere of the compartments still more unbearable. Then the managers did what they should have done at first; they adopted electricity, or rather they began to experiment with electricity on their trains, and such success has been had that it will no doubt soon be a permanent institution on their line.

RELATIVE EFFECTS OF ELECTRICITY AND GAS IN A THEATER.

Everyone knows that illuminating gas vitiates the atmosphere while electricity does not. The relative effects of the one and the other are not so well known. Dr. Dreslauer, of Berlin, has recently investigated this subject and the results of his examinations are both interesting and instructive. For purposes of comparison he very wisely took a crowded theater, that selected being the Theater Royal at Munich, and in the *Gazette Allemande de Medicine* he recounts and comments upon his experiences. He examined the air of those parts of the theater which we designate pit, dress circle and gallery, and found the temperature thus relatively augmented in the different portions of the house:

	Electricity.	Gas.
Pit	2° 5	25° 1
Dress circle	8° 1	26° 1
Gallery	9° 3	26° 7

Again the proportion for 1,000 parts of carbonic acid were:

	Electricity.	Gas.
Pit	0.555	3.926
Dress circle	0.870	3.151
Gallery	1.178	4.533

Hygrometric observations were made of the matters held in suspension in the air. Here are the results:

With electricity the rise in temperature is almost imperceptible; the air remains pure, or rather what impurities it receives do not come even indirectly from the use of electricity and contains but little carbonic acid, and no products of imperfect combustion, as is the case where gas is used, nor is there introduced into the atmosphere the vapor of water, as is also the case with gas. The composition of the air remains practically unchanged throughout the house, whereas with the use of gas the higher up you go the more heat, humidity and contamination is found.

A WORD WITH YOUNG INVENTORS.

The inventor is of necessity an enthusiast, otherwise his brain fruit would suffer for want of nutrition, and die an imperfect creation. It is not necessarily proof of the inadequacy of an invention that the public cannot be made to see in it all the rainbow tints which its parent, its creator, is capable of discerning—nor, on the other hand, is the public without some knowledge, some ability to judge of the future usefulness of the inventor's pet offspring.

The enthusiasm of the inventor will, perhaps, lead him to believe that he has reached the sought for goal while it is still in the far off darkness, and often on a widely diverging road from that over which the laborer is traveling, and he too frequently places the result of his efforts before the public in a crude, imperfect condition, trusting to a leniency on the part of that severe critic, which he has no right to expect, with an inward hope, mingled with some misgivings, that "it will do," for with all its faults it is better than anything of the kind heretofore made or used.

In electrical inventions this sort of prematureness is particularly disastrous in its results. All who have pursued electrical experimenting, of even the simplest kind, know how apparently capricious this force is, and how differently the outcome of a laboratory or table experiment may be from the action of similar combinations, circuits, apparatus, or what not, when harnessed up for every-day work. A quadruplex, which, arranged in an office, with artificial lines, resistances, etc., may work admirably, while the same combination in actual service over a moderately long line would drive two chiefs crazy, and ruin the business of the company.

Far back toward the commencement of the telegraph business, perhaps in '48, an inventive genius in a Western State accomplished what was then the great desideratum of the fraternity—a repeater. It was set up, it did its work; automatically repeating between the East and West, and was considered a wonderful invention—a bonanza. The inventor took it down to New York and put it up as nearly as possible as it had formerly been arranged, when it worked perfectly; but it positively refused to repeat. It was coaxed and wheedled, but oil and files, and screw-drivers, and hard words, were all in vain. It never would repeat again, and the almost heart-broken inventor returned home without knowing why it thus refused to do its work. In those days there were no condensers—no one had ever heard of a duplex or a quadruplex—such a thing as an electrical balancing of two lines was unknown, unborn.

The anecdote is only related to show how the most sanguine electrical inventor may, when he least expects it, find himself balked by a law or a lacking which he had no means of anticipating or preventing in his laboratory or in his shop.

There is a moral in all this, which the young inventor may, with profit, treasure up for future reference.

Curb your enthusiasm. Keep your invention to yourself until you can honestly say it has passed through the crucial test of many trials before you put it upon the market, with a possible chance of having to withdraw it or to replace it with an improved form of the same apparatus.

Don't get into fairs and expositions, and go before associations with an imperfect piece of work—one which is open to even trivial objections, that you hope may be overlooked, but remember the public is critical, especially in the matter of patents. You cannot hide a weak spot in an invention. Remember that no one man is mentally superior to all the rest of the world.

UNDERGROUND WIRES AT THE CONVENTION.

The discussion of electrical subways which came up during the second day's proceedings of the National Electric Light Association is of more than ordinary interest just now for reasons which are immediately obvious. The opinions of practical electricians like those who took part in this discussion, men who can have no possible object of espousing either the one side of the question or the other, save in presenting the facts as thus far brought out, ought to carry much weight, and we cannot refrain from the hope that the public generally, and especially those who have to do with the making of laws and the passage of ordinances, may be put in the way of properly informing themselves on this very important matter. It will be seen that the speakers on this subject do not say that the burial of the wires is either impossible or impracticable. On the contrary they give it as their opinion that it will yet be accomplished. But they maintain that it has not yet been demonstrated that an efficient and economical means has yet been found. They do not say it has not been found, but only that the required results have not been demonstrated. In other words they simply gather the facts together carefully and point out the conclusion which is furnished by them.

Inferentially they recommend that the law makers "go slow" not only in the interest of the electrical companies, but in that of the public as well. The necessity for this timely advice will readily be seen by those who are aware of the hasty action now being taken in more than one part of the country to compel the sinking of the wires within a given and limited period of time.

One of the speakers aptly illustrated the present condition of the project by quoting a portion of the finding of the New York Commission, the members of which traveled far and near to witness experiments and listened attentively for many months to projectors, inventors and eminent electricians, and then declared it to be their undivided opinion that, "the difficulties which surround the successful solution of the underground wire problem in this city are of an extent and magnitude of which the public, as voiced in the general press, at least, have no adequate comprehension."

There is at least one, and perhaps several systems which give promise of possessing the attributes which are required in a successful underground service. But it should be remembered that electrical science is yet in its infancy and that all the details of the work in hand are yet in the experimental stage. It is therefore, manifestly unjust to insist upon the elaboration and completion of the underground system until these experiments have been made; until imperfections shall have been sought out and correctives applied; until that which is efficient but costly shall be replaced by simple and inexpensive contrivances; and finally until at least that much perfection is attained which will guarantee to the public a cheap service and to the companies some assurance of a profit on their outlay. There seems indeed to be a greater necessity for going slow at this time than two years ago, because some of the systems and contrivances which at that time gave promise of success are now known to be lamentable failures. Such is the system which for two years has been in use in Washington, and which has so long been used by a certain class of legislators and the press as an argument why the wires should be instantly put in the ground. In this Washington system the wires were buried in plaster, but the difficulties which have been encountered in furnishing the public and the departments with good service that they have now been taken out again and strung on poles. In this much-vaunted system the machines often ran dead because of leaks and other difficulties, and seek with what diligence they might, the companies' electricians and experts often sought for days without being able to locate the position of the disorder.

It can scarcely be maintained that the electrical companies have not used due diligence in finding a means of burying the wires, and no one familiar with the obstacles in the way of success will be surprised that, in the comparatively short time the subject has been under consideration, complete success has not been attained. Air being the best insulation for conductors of electricity and ground the worst, it is by no means discreditable to the experimenting electrician that he has not yet found a means of establishing so good a service in the ground as that the public has got accustomed to receive on suspended wires. Making haste slowly is a good rule, and one particularly applicable in the present case.

The legal fight commenced at Youngstown, O., several months ago by the Telephone Company against the Electric Light Company has been in abeyance since Judge Thayer issued an order that the latter must run a return wire, and also keep thirty feet away from the telephone wires, as the latter would be rendered useless by induction. Since then each company has expended a large sum in securing depositions to be used in the further trial of the case. Superintendent Wilson, of the Telephone corporation, whose office is in Chicago, was here, and after an investigation instructed his counsel, General Jones and George C. Hatch, to proceed at once and cause the arrest of officers of the Electric Light Company, alleging that they have violated the injunction in a number of instances by running their wires within thirty feet of the telephone wires, rendering the service of the latter practically useless. It looks like a ridiculous proceeding.

CHICAGO ELECTRICAL NEWS.

Among the great original and only true and genuine inventors of the telephone, and the railway telegraph, and the Lord knows what else, who proposes now to put an effectual stopper on Prof. Gray, is Henry C. Strong, of Chicago. This new Tichborne has claimed that Gray's multiple telegraph "was by trickery and deceit" stolen from him, and was nothing but "a reproduction in principle and design" of his invention. He has filed a bill in the Supreme Court of the District of Columbia against the acting Commissioner of Patents and the multiple professor, asking an injunction to stop the issuance of a patent to that gentleman.

He charges, on information and belief, that by complicity with examiners, Gray was about to receive a patent, and that, through Gray's undue influence, the issuance of a patent to him—Strong—had been delayed.

But Prof. Gray says: "I don't know who Henry C. Strong is, and I don't understand this move. How can a man steal from another, unless he is conscious of his having something worth stealing? The bill has no foundation whatever to rest upon. My patents for "multiple telegraph" were issued in 1874, 1875 and 1876. I don't think there was anything later than 1876. I suspect Strong is a fellow I met in Chicago about a year ago. A man of that name came to see me, and talked in a crazy kind of way about his inventions, of which I could neither see the head nor the tail. Not knowing there was such a man in the world, I couldn't have taken anything from him."

What is there in electricity that makes men act so with the Patent Office examiners? They are constantly getting these poor innocents at Washington in bad odor on this telephone question. Awhile ago it was Bell, now Strong says Gray is corrupting these poor fellows. It should be stopped at once.

Under Minneapolis date of the 4th instant the melancholy news of the death of Wm. H. Brockway, superintendent of the Brush Company at that place, is announced. Mr. B. was in the act of adjusting a light while the current was on, he supposing that the lamp—in accordance with orders—had been taken off at the circuit.

Mr. Brockway was well known among electric light men, and his sudden demise is another instance of possibilities born of that assurance which arises from long familiarity with danger.

A change has taken place in the superintendency of the Wisconsin Telephone Company, Mr. Hibbard retiring, to assume a responsible position with the Long Distance Telephone people, with headquarters in New York, while Mr. Madison, of Wisconsin, will hereafter fill the position thus vacated by Mr. Hibbard.

Mr. Ward, of the Fort Wayne Jenny Agency here, has tired of the business, or for some better reason has gone into the jewelry and notion business on Fifth avenue. In addition to what money capital Mr. Ward and his good-looking partner, Smith has, they both carry to the new concern lots of good wishes and hopes from the electric light people.

Mr. A. L. Fowler and Mr. C. Emery, new comers here, will hereafter be found at the Chicago office of the Fort Wayne Jenny Company.

The Freeman Electric Light Company, of Chicago, recently organized by license from the Secretary of State, with a capital of $500,000. The corporators are Arthur L. Chetlain, Wm. M. Prindle, and Geo. W. Cothran, all of this city.

The promises which the organizers and promoters of a new lighting system here give us, are astonishing as well as extraordinary. By their process a mathematically steady light will be given us, and electric light will be cheaper than that kind of beef which is traditionally low priced at a penny a pound. They promise us that about forty feet of wiring will answer the same purpose as half a mile of some of the present systems. We are lost in admiration when we contemplate the good time so soon to arrive, and sound this note of warning in advance, that all who are getting five or eleven arc lights and thirteen to twenty-one incandescent lights to a mule-power, and those other chaps who are getting ready to furnish illumination for light houses and beacons by primary, self-renewing-never-wear-out-but-even-stronger-by-use-and-abuse batteries; to these and similar honest, hard plodding promoters of the public weal, timely warning is given that they may sell before the crash. To clothe the thoughts of one of the new system directory here, "Bish millah! I have said!"

Hyde Park, in this county, has had a sensation. On the 7th instant, the American Bell Company filed a bill in the United States Circuit Court against W. L. Robinson, of Hyde Park, for unlawfully using and furnishing to others to use, instruments covered by the Bell patents. The instruments in question are not the property of the Bell company, but are quite similar in construction. Who the maker is no fellow can find out. The bill complains that the defendant used and also rented instruments for money, and asks that he may be made to surrender all such instruments, and pay over the ill-gotten gains he has been enabled to collect, and that he retire from the business.

An important decision was rendered on the 7th by Judge Brown, at Detroit, which may have a decidedly favorable influence on the question of lighting cities in the future by electricity. Gas companies all over the country, in order to prepare for the wrath to come, whether this be in the form of an opposition gas company, or some electric light promoter, have been obtaining long-time contracts for street lighting.

The case alluded to above is a case in point. Saginaw City recently contracted with an electric light company for lighting the city, and the gaslight company asked of the United States Circuit Court an injunction, based upon the exclusive privilege—under a Council resolution in 1868—of lighting the city for thirty years. The judge held that the company took nothing by the franchise but the privilege of lighting the streets with gas, and will continue to enjoy this as far as its patrons prefer the use of gas to electricity; but its claim to the exclusive privilege of lighting the city by all methods of illumination cannot be supported upon legal principles, and hence an injunction was refused.

The Redstone Electric Motor Company, at Chicago, was incorporated on the 9th inst., with $100,000 capital stock. Edward Hine, Edward A. Irwin and Thomas Murphy, incorporators.

In addition to these, the Ball unipolar and the Bain system are on exhibition.

Giles Brothers exhibit their magnetic shield, illustrating magnetism in watches and the cure for this uncomfortable condition of things, both as an experiment and as a permanency. Mr. Giles has a very happy faculty of interesting a listener on this subject, which has become a favorite with him, and one on which he is well posted.

There is in a remote part of the building one of those cunning professors who has learned to "crib, cabin and confine" the erratic force we call electricity, and mingling this by some species of witchery with "gras de muton," he makes an electric salve, which cures all the ills this flesh is heir to, save hunger. He says the electricity is released, and goes direct into the system from the point where it is applied. And another has an electrical smelling bottle, in which the current is generated as fast as needed. This cures headache, nervous weakness, etc.

To quote the remark of one of these learned professors, "We are only in our infancy in our knowledge of electricity," and there is no controverting the fact. In beholding these astonishing revelations, we can only "concur with the gentleman last up," and bow in awe to the massive brow of the learned pundit and scientist, who retails greased lightning at twenty-five cents a box, with a treatise on electricity thrown in.

CHICAGO, Sept. 13, 1886.

BOSTON ELECTRICAL NEWS.

One day, while satisfying my antiquarian taste by hunting among a collection of old papyrus, I charced to find one which had been previously overlooked. The librarian kindly consented to let me take it to my room on condition that I should return it the next day. It was written in the old sign language of the toilers of the Nile.

This is the record of Sa, of the city of Dymath. Two companies were struggling for the right to light the mighty city of Dymath. The Thothmes Electric Light Company, to win the favor of the people, would keep their lamps burning later than their rivals, the Ra Electric Light Company. On each night a slave was sent from the Thothmes station to see when the Ra Company's lights were put out. One night a new slave was sent to perform the duty of reporting, and returned in a short time to say that they were still running. Sent again and again, he made the same report that the lamps of the Ra Company were still burning. At last the head man, in desperation, rushed out, found that the Ra lamps had been out two hours, and that the slave had been looking at one of his own lamps. The cries of the poor slave, when the head man returned, were drowned in the laughter of the engineers and dynamo men. One has only to mention the circumstance to hear a voice of many volts sound through a resistance of a fraction of an ohm.

One day, as an attendant in an electric light station, after oiling the bearing and commutator, switched in the lamps upside down, a young lady, who was visiting the station, remarked to her escort that the lights looked funny. "Awh, yes, you know," he replied, as he used the handle of his cane to enunciate his vowels; "he's been putting too much oil on the machine, and when it gets to the lamps it makes them burn up, don't yer know."

Scene: Testing-room of electric light factory. Enter new boy, who thinks he knows all about electricity. He attaches the lamps to the line, but before turning on the current steps to the adjoining room to remove his coat, as the day was somewhat warm. Returning, he switched on the current, and, beginning at one end of the line, attempted to adjust the mechanism of the regulator. At the Institute of Pankaology he had studied the hyperbolic curve of the hissing arc, and now attempted to put his theories into practice. Looking along to the end of the line, he noticed a lamp was not burning. Testing the motion of the armatures and solenoids, he found nothing out of order, when the errand boy, going through the room, sung out to him, "Say, sonny, you've got your lamp cut out." Laugh from all hands in the room. The present difficulty relieved, he proceeded to tinker the lamps, and came to one which not only refused to burn, but when cut in the whole line would not burn. Testing the moving parts, he found nothing was out of order, and called the attention of the foreman of the room. The foreman, after spending fifteen minutes in playing with the lamp, took it to his bench and sent for the head superintendent of the factory, who declared that the lamp was out of order, the foreman of the lamp department insisting that it was all right. An hour spent in controversy and experiment revealed the fact that they could not ring through it. One of the boys called the foreman aside and talked to him a moment. A smile lit up the foreman's face. The whole force of the testing room were now near by, who to a man disliked the superintendent. "Something may be the matter with the carbons," began the foreman. "That's all right," growled the superintendent, "it's copper-coated." "But just take them out," insisted the foreman. Removing the lower carbon, good contact was found. "'Umph," grunted the superintendent. The upper carbon, when removed, revealed some paper, thoroughly insulating the carbon from the carbon-holder. The shout which arose was loud enough to throw off the main belt of the engine.

Candidates for the degree of B.s in electrical engineering already have the subjects for the thesis assigned in part. The study of the inverse electromotive force of the electric arc and the causse of hissing will be continued this by some of the pupils under the supervision of Professor Cross. It is hoped that when the causes for the poor working of the arc are known that means may be found which shall prevent all trouble.

A visitor to the cultured Hub, among the thousand and one wonders, visited the beautiful station of the Brush Electric Light Company on Ferdinand street. This station, for convenience, adaptability for work, elegance and refinement of architectural design, and fashionable neighborhood, leave nothing to be desired. The statement being made that the company intended to add to the capacity of the station about 1,000 incandescent lights, he remarked: "I understand that the current from your station has been steadily diminishing for some time. You have been taking too much from the elements, and there is certainly not enough electricity in the atmosphere to supply the increase. On investigation, a REVIEW reporter found that the roof of the station is constructed in such a way that it can be thrown open, so as to influence the circularly polarized molecular vibration of constituted matter for a distance of about twenty miles. Besides, the station is built in such a section of the city that it is open to every electrical and magnetic property, and where nature is very bountiful in her production; and, as the Mayor of the city is also manager of the Brush Electric Company, it is necessary that the influence of the station should be unlimited, and possessing, as he does, unsurpassed personal magnetism, the resources of the station are beyond the amount needed for years.

The working model of the Enos electric elevated railroad is now in operation at the Industrial Exhibition at Chicago. The Winthrop Electric Railroad Company, who have a charter to build this system in the town of Winthrop, Mass., seem to do little towards carrying the construction of the road. It was for a time reported that the company could not place their stock. This was not true, as the people of Winthrop are very anxious to have the road built. The facts of the case are that the Winthrop company having the franchise to build a road refuse to fulfill their obligations in this respect unless the parent company—the Enos Electric Elevated Railroad Company—give them the right for the whole of New England. Attempts are being made to determine whether the name of the pork-producing vertebrate should be spelled with one or two g's.

Some months ago among the numerous improvements brought out by the New England glass works in the manufacture of artistic glass ware, was a method which gave to glass such a surface that it seemed desirable to try the effect on arc light globes. The process is patented, and consists in roughening the surface of glass without leaving any sharp angles. It has long been a question among practical electric light men why from 30 to 40 per cent. of light is lost in using ground glass globes. The surface of ground glass is composed of numerous small planes, making all sorts of angles with each other. In passing through the best of plain glass, nearly 10 per cent. of light is lost. If light, in attempting to leave a substance, makes an angle greater than a certain amount, the light is reflected back again to the other edge of the glass. If we consider that much of the light passes and re-passes a number of times through the glass, much is lost. By the new process in treating the glass, a surface is produced without sharp angles, and no light is lost by total reflection, and at the same time it is as well diffused as if the luminous surface were as large as an apple. Not the slightest shadow is caused by the lamp rods, while the illumination is equal to that of a plain globe. The same process applied to incandescent globes would give excellent results. F. M. G.

Telephonic News

*** There are now 8,000 miles of overhead wires in London. The local authorities have control over the wires only where there is an interference with the roadway.

*** The Texas *Rail and Wire*, of Fort Worth, says:

"The Erie Telephone Company has abandoned the field at Denison, Decatur, Weatherford and Longview. The Pan-Electric run them out of the former city; but at the other places the people couldn't stand the rate."

*** The applications of electricity become more varied every day. Telebarometers, telethermometers, telemanometers and telehydrobarometers have recently been invented, which, respectively, record at distant points, air-pressure, heat, steam-pressure and water stages. A California electrician has also invented a process whereby gold, silver and copper can be instantly smelted by a lightning stroke.

*** Angus Hibbard, formerly general superintendent of the Wisconsin Telephone Company, has resigned, to accept the general superintendency of the American Telegraph and Telephone Company, of New York. Mr. Hibbard understands long-distance telephoning, and his valuable services for years in the telephone field are well known to all our readers, and he needs no commendation from us. We welcome him here, and trust his usual success will attend him.

*** The American Telephone Company has been incorporated under the laws of New Hampshire with a paid up capital of $5,000, and officers have been elected as follows:

President and general manager, John E. Robertson, Concord.

Secretary, Samuel E. Clifford, Concord.

Treasurer, O. W. Coon, Concord.

Superintendent, W. F. Locke, Concord.

Clerk, Harry G. Sargent, Concord.

The company has been organized to introduce and develop the mechanical telephone patented by C. M. Radford and the insulator patented by W. F. Locke, and will begin operations immediately.

*** Some time ago the poles and wires owned by the Cumberland Valley Telephone Company in Evansville, Ind., were taken down by order of the City Council, because that company declined to continue to furnish telephone service to the citizens of Evansville under the new State law, reducing the rates of toll charged for such service. Last week the company entered a criminal proceeding for malicious trespass against the members of the City Council, and warrants for their arrest were sworn out. The affair causes much excitement, and is probably the beginning of a long and costly litigation between the adverse parties.

*** The new exchange being fitted up by the telephone company in the Masonic Building in Cincinnati, Ohio, will be the model exchange of the world. This is said by competent and disinterested parties. The exchange room is about 55x35 feet in size, the ceiling being fully 20 feet from the floor. A beautiful stained glass window at one end sheds a mellow light and harmonizes with the richly colored walls and ceiling, which have been expensively papered. The floor is polished maple. Not a wire will be seen anywhere, and the exchange room will be a model for telephone people in all parts to copy. General Manager Stone says that the service will be materially improved when the new exchange is put in use, as all wires will run into the one room, and time can be saved in making connections.

*** One evening last week a party consisting of several of the local managers of the Wisconsin Telephone Company and employes of the Milwaukee office, called at the residence of Mr. Charles Ray, where Mr and Mrs. Hibbard were staying. Among those present were the following local managers: Messrs. Stitch, of La Crosse; Gallagher, of Janesville; Stone, of Ripon; May, of Watertown, and Winship, of Racine, besides Messrs. Parker, McLeod, Knight, Lapham, Germain, Hyde, Yopps, Manning, Reilly, Gaulke and Russell, of the city office. That the presence of Mr. Hibbard might be assured, his wife had been notified of the event; but as she guarded the secret faithfully, her husband was taken completely by surprise. Mr. George F. Stitch stepped forward, and in a very happy speech presented the parting testimonial, a handsome gold watch and chain, bearing on the outside a monogram containing the initials A. S H. and on the inside the inscription: "Wisconsin Telephone Company. Testimonial from his Telephonic Associates"

*** Berlin is at present wrestling with the problem of burying its telephone wires underground. The telegraph wires are already subterranean, and have been so for some time, but the telephone lines have heretofore been carried overhead. If, as has been remarked, the electric wire represents the nerve of civilization, it is believed here that the time has fully come when it is necessary to insist that the analogy shall be carried a step further, so that civilization shall make her nervous system as invisible as the nervous system of man. It is true we have no such monstrous masts in our main thoroughfares as you have in New York, which obstruct locomotion and mar the the beauty of the streets. We have, therefore, not suffered so much from the telegraph engineer as you have. But all electric overhead wires are here universally condemned, and the practice of laying them under ground is becoming quite general in Europe. In Paris the excellent system of drains enables the telegraph engineer to lay his wires in lead pipes fastened to the top of the arch. Throughout the whole of Germany the exigencies of war and climate led to the completion of the underground system of telegraph wires in 1880. In Vienna both telegraph and telephone wires are carried on brackets along the front of houses. In London most of the telegraph wires are buried, but the chief nuisance there, like here in Berlin, arises from the telephone lines, which are increasing daily. It is cheaper to swing a wire in mid air than to carry it underground, for three reasons: First, the aerial line need not be insulated; secondly, the cost of tubing and of excavation is avoided; and, thirdly, the engineer can take short cuts overhead instead of being compelled to follow all the awkward angles of the streets.

*** The system of sound telegraphy used by the people living on the border of the Gulf of Guinea, West Africa, is of interest as a primitive solution of the problem of communication through short distances. The instrument is made as follows:

Take a log of hard wood, about two feet long and about a foot in diameter. Plane off one side longitudinally to a surface four or five inches wide. In the center of this surface mark off an elongated and somewhat distorted Greek cross. The longer arms are placed longitudinally, and occupy about one-third of the plane surface. The transverse arms are three times as broad, and extend entirely across this surface. The natives dig out the wood within the outline of the cross, and from there gradually hollow out the whole log. The sides, beginning at the center, are trimmed off laterally toward the ends, which are rounded off. The instrument is now ready. It will be perceived that by the methods above described we have a hollow drum with four tongues in the center, each of a different thickness, so as to produce a different sound when struck.

Two pieces of bamboo, the size of a man's wrist and about two feet long, are selected and stripped of the hard outside, which leaves the soft, pithy portion for use. This bamboo is of a peculiar kind, free from knots and solid throughout. With these sticks, used in a proper manner on the four tongues of the drum, a combination of sounds is produced, which, in connection with time as used in music, forms a perfect telegraphic language, readily understood by the initiated, the air being the transmitter. With this simple instrument the natives of the Gulf Guinea readily communicate with each other for a distance of a mile at least on land and a much longer distance by water. Messages can be sent long distances in a short time by parties at different points passing them along from one to the other. The writer has seen canoes coming down a river from the bush markets signaling people in the town and giving and receiving general news at a distance of fully three miles.

The Morrison Electrical Works of Baltimore.

For the manufacture of electrical apparatus one of the best equipped, neatest and best managed concerns that we have seen for a long time, we had the pleasure of visiting in company with President Morrison the other day.

These works were established only a few years ago with a limited capital, employing only a few hands. But to-day the pay roll amounts to $500 per week and the value of the building and machinery is not less than $100,000.

The manufactory is divided into four floors or workshops, each well stocked with tools of the most approved patterns and the best makers, chief among whom stands the name of the well-known firm of Pratt & Whitney.

The basement is used as a blacksmith's shop and for the storage of heavy material. It also contains a buffing and polishing machine and emery grinders. Here, too, are numbers of large boxes which seem familiar to us as being types of the patrol police boxes.

On the first floor is a well appointed office with every appliance that the most fastidious book-keeper could wish for, and contiguous to the office and separated from it by a glass partition is the machine shop. Here are large and small lathes, punching press, drilling machines, shaping machines, vises, a high speed automatic engine of 40 horse-power, an automatic planer which cuts a plate of steel as quick as a cheese cutter runs through a piece of cheese, a new dynamo machine which the busy hands of the workmen are putting through its first trial. Each machine has a man to work it.

Careful and mature judgment in the choice of tools and machinery is absolutely indispensable, for the accurate manufacture of the various instruments which this firm produces for the scientific savants of this and other cities. The second floor is used for the manufacture of electrical instruments. Here are to be seen Monitor lathes, 3 and 4 spindle drill presses, milling and wheel cutting machines, circular saws that cut through a sheet of metal in a few seconds, lathes, self acting, and others of all kinds and sizes.

On this floor is a store-room in charge of a reliable man, who supplies the workmen with whatever is necessary to carry on their business.

The third floor is a model shop. The tools are the perfection of modern mechanical art. Who has not heard of Brown & Sharpe's famed machines? The universal milling machine works so like a human being that the wonder is that any attention should be given it at all, after the work is given into its steel jaws. Here can be seen the gear-cutting machines, the drill presses, the turret machines, the cute little shapers, the lathes—large and small—and an almost countless kind of tools whose uses are only known to the initiated.

The work carried on in the second and third floors embraces a wide range—from a Morse key to a motor. Some very fine specimens of mechanism can be seen here, including electric lamps, experimental work for inventors and surveyors' instruments, such as levels and transits. There is also in course of construction an astronomical telescope, which will be put in the market at such a low figure as will bring it within the reach of amateur astronomers, who now must content themselves with inferior instruments.

As orders are coming in so rapidly from all parts of the country, at no distant day the enlargement of the establishment may be looked forward to. One has recently been received for three hundred motors from a quarter to a two horse-power, to be used in driving fans, sewing machines, printing presses, and other mechanical devices to which they can be attached with advantage. There is also on hand the construction of one of the largest galvanometers in the United States, which will be a model of accuracy of detail and workmanship. It is made under the supervision of two scientific gentlemen of Johns Hopkins University.

Western Union's Latest.

THIRTY-SIX WIRES STRUNG ON THE ELEVATED RAILROAD STUCTURE.

"The Western Union Telegraph Company last week made another of those daring moves for which it is rapidly becoming notorious. Fifty men were set to work on the structure of the Third avenue elevated road and ten or twelve miles of electric cable were strung alongside the tracks. At any time such a sudden and unannounced proceeding would excite attention. Just at this time, when the subway is fairly in course of construction, and the law compelling all electric companies of this city to place their wires therein, is so generally known and understood, this measure is regarded as foreshadowing a legal fight on the part of the Western Union and a determination not to allow the wires to be put underground. The company own 30 per cent. of all the wires in the city.

Friends of the company assert that yesterday's proceeding was merely a makeshift. If this be the case why was there any necessity of beginning the work without the slighest warning to the public, and further conducting the operations with the extreme secrecy which was observed yesterday?

The foremen in charge of the business declined to give any information. The only requisites for laying the wires were a few reels of cable, a score of pulley blocks and some tarred cord and a few able-bodied linemen. One of the enormous reels was placed near the edge of the station platform. Two men proceeded to pay out the cable, which, running through a block suspended from the roof over the platform, was readily dragged down the road by the efforts of a half-dozen linemen. The plank walk along the west side of the Third avenue road furnished an excellent field of operation for the men who drew out the cable. The work was begun at an early hour in the morning, and before noon a double cable stretched from the Twenty-third street station to the Fifty-ninth street station. By six o'clock great progress had been made. At that hour the Western Union Telegraph Company had thirty-six wires beside the tracks, reaching from Twenty-third street to the Harlem River.

These thirty-six wires are inclosed in two separate cables, one of which contains nineteen wires and the other seventeen. Each wire in each cable is separately insulated and the cables themselves are wound with strips of rubber cloth. For a large part of the distance covered yesterday the cables are conveniently located on the plank foot-path on the west side of the downtown track. Each section of this foot-path consists of four planks, each about eight inches wide, laid parallel, with gaps of about two inches between each pair of planks. These interstices offered the neatest place for the cables, which, as they are but one and a-half inches in diameter, very nicely fit into these gaps. This was the method of laying the cables along the greater part of the distance, and so neatly do the cables sink out of sight that no one but a close observer or a person forewarned of their position would ever detect them.

At the Forty-second street station the branch tracks leading to the Grand Central Depot made it impossible for the workmen to lay their cables in the usual manner. They accordingly dropped them over the edge of the footpath and carried them along under the station. Above One Hundred and

Twenty-fifth street the entire cable was suspended under the girders of the structure.

All inquiry as to the intent and purposes of the company in doing this was futile. "Mr. Brown," as one of the foremen was definitely designated, and all the other men who were apparently superintending the work, refused to speak about the matter. Superintendent Wm. B. Somerville was persistently sought but could not be found, and Superintendent Walter C. Humstone was too ill at his Brooklyn residence to hold any conversation. Night Manager Sink, at the main office of the company, declared that he knew nothing about the matter. All the other officials of the company who were accessible made similar answers.

Mr. Roswell P. Flower, President of the Subway Commission, in reply to a question as to the probable action of the commission in the matter, said they would take no immediate action. "As I understand it," said he, "no one yet knows the company's purpose in placing its wires on the elevated road. It may only be a makeshift, as they cannot put up any more poles, or it may be a separate arrangement for through wire. Until our subway is ready to receive their wires we neither can nor shall take any legal action against the company. The law, however, is perfectly clear, and authorizes us, on the completion of the subway, to force all electric companies to lay their wires in the subway conduits. If any company refuses to comply with this law we shall legally force them to comply. And so with the Western Union. I suppose at present they can lay their wires where they please, providing the property owners, whose rights they infringe, do not object. But every wire of the Western Union Company will have to go into the subway when it is finished."

The New Victor Combination Set.

In combination sets of telegraph instruments for short lines, the value of a sounder that will work upon a small battery becomes vividly apparent. The anxiety to reduce the battery upon private lines is great for obvious reasons, and it would seem as if the best way to accomplish this object is, other things being equal, to keep first the armature of the sounder within the magnetic field at a point where it will feel the maximum magnetic force exerted; second, to reduce to a minimum the length of oscillation of the armature, and third to so hang the armature that it will be most susceptible to the influence occasioning the oscillation, whether it is magnetism, as in the down stroke, or mechanical force, as in the up stroke.

Friction in trunnion sounders sometimes increases its own retardation, for the reason that the additional force employed to overcome the initial friction resulting from the weight of the lever and large bearing surface of trunnions creates additional friction still and need for more magnetism and more mechanical force and thus continues to multiply its original defect.

Too, where trunions are employed unless they are set within the trunnion screw sockets with a nice exactness, one end is sure to fall below the level of the other and prohibit the armature being brought as low as desired to the magnet cores, for fear that the lower side will touch and "stick." Should the trunnion screw be turned up to prevent this, stiffness at the bearing, is sometimes the result it is claimed.

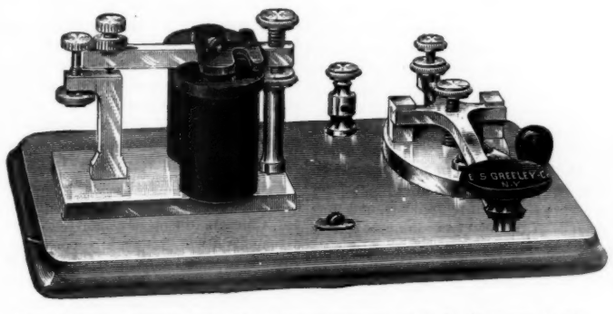
In the "Victor" Sounder, which is the instrument used in the combination set, which is the subject of this illustration, there are no trunnions whatever, the armature being mounted upon what are pratically needle points, offering no more bearing than is found in a galvanometer and replying in almost as delicate a manner to any force exerted upon it. These needle points are located at a distance from the magnet cores, that is, much reduced from what is the case in bearings where trunions are employed. The result of this reduction of distance is necessarily to reduce the length of oscillation at the armature and to keep the armature within an intensely magnetic field, and to give the least possible friction.

To any one having use for these goods we commend an examination of the Victor Sounder, which bids fair to rival in the craft's estimate the popularity which has been gained by the celebrated Victor Telegraph Key, which is associated with the Victor Sounder in the above illustration and is too well known to require any explanation here.

Underground Wires.

The two Boards of Electrical Subway Commissioners in New York and Brooklyn have had very different experiences, and have adopted different plans. The problem of putting the wires underground is not the same in the two cities; the construction of the law by the two boards, their relations with the electrical companies, and the consequent course pursued by the latter, have not been alike in Brooklyn and New York. The concrete conduit adopted by the New York Board has been permitted as an experiment at the request of the Telephone Company, on a part of the Brooklyn lines.

It is not our purpose to criticise these differences. We wish rather to point out a fact which affects both boards in common—and, by the way, we do not mean the fact that neither of them has had a cent of money from the State, and that they have had to do



THE VICTOR COMBINATION SET, MANUFACTURED BY E. S. GREELEY & CO.

whatever they have done at their personal expense and without remuneration. That is a circumstance which might well temper the criticism of the newspapers, even if conscious ignorance did it. But we would call attention to another circumstance, which few, outside of experienced electricians, have seemed to know—namely, that the problem of underground electric communication, as presented in American cities, not only has not been solved in Europe, but has not been seriously attacked.

This statement may surprise some of the smart editors who have frequently declared that the way to put the wires underground is to "do it, as they do everything in Europe." But vague and sweeping assertions of that kind cannot stand against the results of thorough inquiry.

President Plympton, of the Brooklyn Board, has just returned from a journey, undertaken for the express purpose of ascertaining the exact condition of this question abroad, and including personal examination of the systems in use at Liverpool, London, Durham, Newcastle, Brussels, Antwerp, Cologne, Wiesbaden, Frankfort, Heidelberg, Berlin, Munich, Lucerne, Venice, Milan, Turin, and Paris. These cities represent every method of distributing telephone, telegraph, and electric light wires now practiced or proposed abroad.

Telephone wires are not underground anywhere, except in Paris, Bordeaux, and Newcastle.

In Paris, all wires are placed in the sewers, so far as these extend. Where there are no sewers available, the telephone wires are extended over the house tops, while telegraph wires are placed in cast-iron pipes. The Paris telephone system is not comparable for complexity and extent with that of American cities. It does not involve a vast, growing, and shifting number of scattered subscribers. About 4200 subscribers are served through the sewers, and 200 with aerial lines; and no excavation for the purpose of burying telephone wires has ever been made in Paris. In other words, with 95 per cent of a complete underground system ready furnished without cost, the Paris electricians have not undertaken, and do not now propose to construct, the other 5 per cent.

Bordeaux has a small telephone system in iron pipes. It is not working satisfactorily, which is, perhaps not specially the fault of the pipes. The system presents nothing novel or suggestive. All other French cities have their telephone wires in the air. The total number of instruments in all France, outside of Paris, is only 2200.

Newcastle has a small system successfully buried. There are less than 600 telephones in the exchange, and the case presents no special novelty. The wires are in pipes, and metallic circuits are employed.

There is in London an underground telegraph system, but the telephone wires, except a few government lines, are all overhead.

In Germany, only the military telegraphs—no telephone lines—are underground.

In Belgium, telephone wires are exclusively aerial, and there is no expectation of anything else, if conclusions may be drawn from the rate at which iron fixtures on house-tops and in the streets are set up, including a new line of handsome "poles," a mile long, in Antwerp. The Antwerp system is copied in Sweden, where it was introduced by the engineer now in charge at Antwerp.

In Italian cities, telephone wires are largely carried on brackets under the eaves, because the construction of the roofs makes the erection and maintenance of supports upon them impracticable. There are no underground telephone systems in Italy.

President Plympton found, moreover, that the electrical problems presented by the scheme of placing underground all electrical conductors had received little attention abroad. Nobody was thinking of doing the thing, and hence nobody had attempted to overcome its difficulties. The nearest approach to it is in Berlin, where the Edison Light Company is permitted to place its conductors underground, keeping them two meters from all buildings which they pass, and one meter from any other wire (such as a military telegraph). Where the Edison wires cross other lines, they must be one meter above or below the latter, and must be inclosed in iron pipe, presumably as an induction shield. Induction being at a minimum anyhow when two conductors cross at right angles, this is merely an easy and probably sufficient solution of the simplest and least troublesome case.

The electric lighting companies of the United States often employ currents of higher tension than those used in Germany (by the Siemens system, for instance), and they supply also the alternating current, which has many advantages, but undoubtedly increases the difficulties connected with induction. On all the subtle and critical questions raised by these conditions, foreign experts are absolutely dumb. They may be thinking unutterable things, or they may be making in secret indescribable experiments. But they have reached no result; and they regard Americans engaged in that line, sometimes with awe, as superior beings, sometimes with amusement, as persons who rush in where superior beings fear to tread.

It is plain that there are reasons enough for permitting our Boards of Electrical Subway Commissioners to move with caution and care. The Brooklyn Board, which has had the easier problem of the two, has accomplished a good deal. There are at this moment more miles of telephone wire actually working in Brooklyn in underground conduits constructed for the purpose than in any European city. And the enterprising editors who periodically call for more vigor, and want to have things done "as they are done in Europe," are respectfully informed that in Europe little has been done and less is now doing."

.... The Chicago, Millwaukee & St Paul Railroad Company have adopted the Edison-Gilliland-Smith system of telegraphing between trains and stations.

.... The Canadian Pacific Railway Company's telegraph system, which is now completed throughout Canada from the Atlantic to the Pacific, and to be run in connection with the Postal Telegraph Company's wires to New York and through the United States, was opened last week to the public. Arrangements have been consummated with the Commercial Cable Company for European service.

.... Looking in at the Western Union operating room and noticing the effect of protracted service, I asked one of the number if they were allowed any vacation. The reply was a sad shake of the head, and hence I was not surprised at the recent effort to diminish the number of hours in a day's work. Only those engaged in telegraphy can form any idea of the intense application required, or of that incessant manipulation, which so often results in paralysis. Operators formerly received from $100 to $120 per month, but now $60 to $70 is called good pay, and in the country offices the rate is still less. This is not very encouraging when we consider that often a man is worn out before reaching middle life. On further inquiry I learned that the number of this useful but ill-paid class is estimated at 10,000, and as they are now required to both receive and send by ear, only experts can hope for employment. The reason for this requirement is found in the fact that the registers often get out of order, and a well-educated ear is far more accurate than any instrument.—"*Gath,*" *in Cincinnati Enquirer.*

.... The St. Paul *Pioneer Press* says: There is no doubt that competition is a good thing for telegraph companies as for other business organizations, and that it has spurred the Western Union to new efforts to satisfy its customers in the Northwest. But much the greater part of the abuse which has been showered upon the Western Union Company by certain newspapers who failed in inducing it to subordinate the public interests to their private advantage is wholly gratuitous, groundless and malicious. The oft-repeated assertion that that company has not furnished facilities to keep up with the rapidly growing business of the Northwest is met and refuted by the statements made by Superintendent McMichael in a letter published elsewhere, showing that within the last four years the increase in miles of poles in the old Northwestern district has been 7,000, and in miles of wire 20,000—while the force of employes has been increased 107 per cent. at St. Paul and 77 per cent. at Minneapolis. Rapid as has been this increase, Mr. McMichael admits that during the past summer their facilities were for a time overtaxed by the unprecedented activity in business, but that the company has made every effort to meet the demand for increased facilities is shown in the fact that during this year it has put 1,500 additional miles of wire in this district alone. Col. Clowry, vice-president and general superintendent, has just made a tour of inspection through this district, extending over a period of four weeks, and states that the service is good and will compare favorably with that in the Middle or Western States. Mr. McMichael gives an interesting explanation of the origin and motive of certain recently published affidavits.

ELECTRICAL AND SCIENTIFIC

* * Mr. Edgerton, of Edgerton Motor fame, sends in the following definition of electricity: Electricity is the energy of molecular vibration caused by any disturbance of the normal attraction or condition of matter.

* * There was a shortage in the supply of natural gas on the South Side in Pittsburgh last week, and several factories suspended operations and private consumers were obliged to eat cold meats. Some people attribute the decrease in the flow to the earthquake, and officials of the companies are now investigating the cause.

* * The new electric launch Volta recently made a voyage on the Thames which extended over 46 miles, carrying a party of fourteen. She is 37 feet long by 7 feet beam, and is propelled by a Reckenzaun duplex motor and a battery of 61 E.P.S. accumulators. By means of a switch devised by Mr. Reckenzaun, the speed can be varied from six to ten miles per hour in still water.

* * Succi, the Italian faster at Milan, will not divulge the secret of his African herb liquor, as he intends to take out a patent for it, and expects to realize a few million francs profit from its sale. He claims that the liquor will become a staple drink among the poor. He says that it will be sold cheap, so that a large family may subsist for a week on a franc's worth of liquor. Succi is visited daily by dukes, princes, senators, deputies, and hosts of foreign doctors. His strength is unimpaired.

* * These are a few of the most necessary inventions. But others are needed also. For example, there is a demand for a cigar that will extinguish itself before it is thrown away, also a plan for paralyzing incendiaries as soon as they decide to wield the torch. Another required invention is an automatic contrivance to pillory tramps before they enter barns and granaries. Still one more device, perhaps the most necessary of all, should not be forgotten, namely, a device for inoculating careless property owners with the spirit of carefulness, or of trepanning their skulls with the sense of watchfulness.

* * The French Minister of Education has just fixed the date of competition for the Volta Prize. It is of the value of £2,000, and was instituted by a decree dated June 11th, 1882, in favor of the author of a discovery which shall render electricity economically useful in one of the following applications: As a source of heat, of light, of chemical action, of mechanical power, as a means of transmission of dispatches, or in the treatment of disease. The competition will remain open to June 30th, 1887, and the prize will be awarded the following December. Scientists of all nations may compete. A commission, nominated by the Minister of Education, will examine the discovery specified by each competitor, to determine if it fulfills the required conditions.

* * The Washington & Georgetown Railroad Company is taking considerable interest in the question of electric motors for street cars, to supersede the use of horses. Mr. C. C. Glover, one of the directors of the road, who is now in Europe, is investigating the Julien system of electric motors now used in Brussels. This company, as well as every other street railroad company, is interested in the question of procuring a substitute for horses as a motive power, and as soon as some substitute is found which is practicable it will be adopted. Mr. Glover said he would look into the working of the Julien system, which the agent in this country claims is being successfully used in Brussels, and if upon Mr. Glover's report the system is found worthy of a trial we shall give it one. In this system each car carries its own motor, being a dynamo under the car, stored with electricity. The day must surely come when horses will be superseded for street car service by some other form of motive power, and I think it will not be by the cable road system, either.

* * The acetate of soda foot-warmers now used for railway cars gradually become cool by radiation, but M. Tomassi, a French electrician, proposes to keep them up to a certain temperature by means of the heat due to an electric current traversing a high resistance. Only the heat lost by radiation is thus compensated for, so that the original high temperature is obtained on the cheaper plan of heating by a fire, or, rather, by plunging the warmers in boiling water. The current employed to maintain their heat is to be supplied by a dynamo driven off an axle of the train, and the circuit passes through all the warmers. A simple device allows of the foot-warmer being thrown out of circuit should it become unbearably hot. The plan will require fewer foot-warmers than are now used, since it will be unnecessary to change them during a lengthy journey. This combination of fire and electric heating is perhaps more likely to be successful for the present than a purely electrical arrangement. Warmers on the latter plan which have been devised are of feeble power.

* * The Compagnie des Entrepots et Magasins Generaux in Paris have large warehouses in Roubaix, where the cotton bales arriving, mostly from Australia and La Plata, are stored before being forwarded to the different cotton mills. On account of the great fire risk, no steam crane is permitted in the establishment, and the bales, which measure about 1½ cubic yards and weigh half a ton each, had, until recently, to be hoisted and generally handled by manual labor. Now the work is done by an electric traveling crane. The crane post is placed on a trolley, which runs on rails, and a rail fixed to the ceiling of the warehouse guides the upper end of the post. The jib of the crane can be raised or lowered somewhat after the fashion of the cranes employed by builders, and thus the distance of the load from the post can be varied. The jib can also swing all round, and the bale can be deposited in any position covered by the sweep of the jib. On the trolley is fixed a small Gramme four horse-power dynamo, running at 900 revolutions a minute when fed with 15 amperes at 250 volts pressure. By suitable gear the dynamo, which is always kept running, can be made to hoist the load, advance the crane on the rails, swing the jib round, or raise or lower it. The current is conveyed to the crane by overhead sliding contacts. The generator is a six horse-power Gramme dynamo, running at 1,200 revolutions a minute, and the commercial efficiency of the whole system is said to be 60 per cent. Formerly ten men could handle 150 bales in 18 to 20 hours. The electric crane, attended by four men, does the same work in three hours.

* * The New York *World*, in discussing the causes of earthquakes, after reading the various theories of scientists, the land slide and volcanic interior heats, contraction of the earth's crust, etc., adds the writer's views on the subject of electrical action, and says:

It seems to us, as representatives of the lay mind in this matter, that the scientific gentlemen do not take sufficiently, if at all, into account the probability that earthquakes do not have a common origin. Some of them, as described in history and seen in our own times, have so palpably been connected with volcanic eruptions that it seems only reasonable to conclude that they must have been caused by the action of the internal fire brought into contact with either the water, oils or gases that permeate the body of the earth. Other shocks again have rolled along under the earth's crust at so rapid a rate and for so great a distance as to suggest the possibility that they may have been occasioned by some disturbance or peculiar condition of the mysterious currents of electricity which are known to run through the bulk of this whirling sphere, as they traverse the atmosphere in which it swings, and, as is believed, the far ether that lies beyond. To one who has witnessed the fury and heard the detonations of a thunder-storm from above clouds, or has looked with wonder and awe in the northern seas upon the unpent and unchained forces when "the spirits were riding the northern lights," the theory seems rational that the still unknown element which men call electricity is the moving cause of at least some of the earth-tremors that have disturbed the surface of our planet.

As to whether this portion of our continent is to become subject to more serious quakings than it has yet known, one man's guess is as good as another's. The immunity from serious disasters for a quarter of a thousand years hitherto should give a large measure of confidence to the dwellers on our coasts.

* * Benjamin Hardwich writes to the New York *Tribune* as follows:

"On the 10th of August, 1884, I pointed out in the columns of the *Tribune* certain indications tending to show that the causes of the earthquake then felt were electric rather than volcanic. It was observed that previous to that and the earthquake in England the cables had been much troubled by electric storms. Certain peculiarities in the phenomena of yesterday seem to support this theory. Down town in New York the shock was distinctly felt. Here the soil is sand and gravel, with some large bowlders. Around Union Square and in the rock area many persons were incredulous that there had been any such occurrence. In East Fifty-fourth street, in a fifth flat, no tremor of any kind was perceptible. Again, in Brooklyn, as in 1884, the shaking was greater than in New York. If the shocks are the result of the passage of a wave of electricity from one area of the earth's crust to another, the difference of movement may be accounted for by the difference of geological formation. The current would pass easily through a rocky formation, causing but little movement, while sand, gravel or loam, possessing less conductivity, would be more disturbed.

It will be noticed that if the movement be attributed to volcanic forces, a reverse of these facts might be anticipated. Rock would transmit the shaking to the surface more effectually than gravel, which would deaden the force so that the shaking would be less felt on the gravel and more on the rock. Again—to epitomize the telegrams—it appears that the shock was severely felt in Cleveland, Ohio, Washington, Cincinnati, Louisville, Detroit, Wisconsin, Jacksonville, Fla., Richmond, Va., and in North and South Carolina, while in Philadelphia, Boston, Chicago, Macon, Ga., St. Louis and Indianapolis it was but slightly perceived. If any one is sufficiently interested to let me know the surface formations of any of these places, it may throw more light on the subject. I see a dispatch from Rochester, N. Y., states that a magnetic storm is raging there this morning."

* * I always did have a scientific turn; so does the implement which imparts the circular motion to a grindstone, though I am unable to say which is the greater success as a crank. Among other symptoms of genius which are rapidly developing in me, I occasionally wrap myself in impenetrable gloom and other wearing apparel, and wrestle with a redundant and conspicuous toothache. Having deposited so many incisors, biceps and molars with gentlemen of leisure, who make a business of collecting such bric-a-brac, I began to fear that I should soon be compelled to live on codfish balls and mush the remainder of my days. What wonder, then, that the following from the *Electrician* attracted my attention: "If a thin piece of zinc be placed on one side of the gum, and a silver coin on the other side, with the aching tooth between them, and then the edges of the metals brought together, a weak galvanic current will be established that will cure the pain." I immediately gathered up my wife's washboard and cut a piece of zinc from it. She made a vigorous protest, but when a man has a tooth in his mouth that is dissatisfied with the management of affairs, his other troubles are as naught. After obtaining the zinc, the next thing was to get the coin. A thorough investigation of my assets failed to reveal even a ten-cent piece, so I went out and borrowed that amount from a friend. In my hurry I laid the piece of zinc where I could not find it again. I cut another piece from the crippled washboard, the tooth rigidly adhering to the ache business and my wife protesting; but something had to be done, and that something I heroically attempted to do. Placing the zinc and coin as directed, I let them touch below the tooth. Jeminy crickets! A thousand tooth aches at once! It was over in a second, and the tooth no longer ached; but the dime—oh, where was he? Half way down my throat, and marching on. I had promised to return the dime in half an hour, but under the circumstances it was impossible, and my friend now regards me as a fraud. Hang those new-fangled remedies, anyhow.—*Goodall's Sun.*

A New Gravity Annunciator.

The Electrical Supply Company, of New York, 17 Dey street, have just brought out a new gravity annunciator, which is a very neat and perfect working instrument. It has no complicated combination of springs to get out of order. Relying entirely, as it does, upon gravity for its action. Once a current is sent through the coils, the drop must fall. The "throw back" raised to replace the drops in position, must come back of its own weight. There are few parts, therefore the liability to get out of repair is reduced to a minimum. It is gotten up neatly, the parts being nickel plated, and mounted either in black walnut, ash, or

A New Gravity Annunciator.

cherry cases. The drops on instruments in stock are numbered from 1 up, but will be numbered or lettered as desired.

Electric Lighting in Elmira, N. Y.

The Thomson-Houston Electric Light Company, of Elmira, is favorably situated for the distribution of current from low tension machines for incandescent lighting. They have a large number of lights within 200 feet of the station and the bulk within a radius of 1,200 feet. Their arc plant comprises 50 lights. For the increase in their business they have as motive power a 150 horse power Corliss. The plant will probably be doubled this fall. F. M. G.

* * The maxim may be supposed to be adopted without hesitation by the electric eel, so far as he himself is concerned; but the animals to which he sometimes gives a fatal shock have been known to dispute the principle. Any one can now, upon obtaining permission, test this matter for himself; for an electric eel has arrived from British Guiana and has been assigned quarters in the aquarium at the Colonial and Indian exhibition. The British public is apparently so fond of *experimenta in corpore vili* with electric machines that there ought to be some one eager to touch the *gymnotus electricus* and willing to tell everybody how far he felt like after the experience. There is a fascination about electricity which will, no doubt, make our new visitor very popular. We revel in electric strops, electric hair brushes, electric gold, electric ladies and electric shocks. Some of these things are genuine, some are not. But we have always a great future for electricity in a country whose inhabitants take so kindly during seasons of amusements to the attractions of the electric machine. What the subtle pleasure of clinging to two handles, while an effervescent mixture of paralysis and "pins and needles" steals up both arms, may be, we do not pretend to understand. But, as people freely pay twopence for this dissipation, a portable, electric eel would no doubt have quite an army of followers. If there is any fear of the exhibition receipts this year falling short, we strongly recommend the commissioners to start the electric eel as an entertainment. Enthusiasts could then take a natural electric shock, with electric light (any color) accompaniment, and satisfy themselves once for all how far "electricity is life."

⁂ The Southern Bell Telephone Company have decided to make a canvass for a line between Atlanta and Macon, connecting with intermediate cities and towns, and if enough encouragement in the way of subscriptions for tickets good for conversations on the line is given by telephone subscribers in Macon, Atlanta and intermediate towns, the line will be built at once.

⁂ An event which has been looked forward to with a great deal of interest by Canadians occurred last week in the opening of the Canadian Pacific Railway telegraph system with through lines from the Atlantic to the Pacific. The line opens with four through wires between Montreal and Winnipeg, a distance of 1,422 miles. Direct connection is also had with Hamilton, Toronto, St. Catharines, Buffalo and New York.

⁂ In Philadelphia the Highway Supervisors on Wednesday last appointed Messrs. Smedley, Walker and Boone a committee to formulate regulations for the laying down of underground pneumatic-tubes, manholes and electric conduits, and approved the application of the Bell Telephone Company for permission to put its wires underground. The plans of the Postal Telegraph and Cable Company for underground conduits on Market, Filbert, Cuthbert and Twenty-third streets and Lancaster avenue were approved. Consideration was postponed of the application of the American Telegraph and Telephone Company, whose route is along Delaware avenue, Walnut street, Girard avenue, Chestnut street and Lancaster avenue. Yesterday the sub-committee reported favorably upon the ordinances and plans.

⁂ A suit is pending in the United States Circuit Court of Chicago, in which the Bell Telephone Company is the complainant. The defendant is the American Cushman Telephone Company, organized for the purpose of manufacturing telephones. This company antedates all previous claimants to telephone patents, claiming that Cushman, the inventor, constructed and publicly operated a telephone at Racine, Wisconsin, in 1851. The Cushman patent is claimed to be identical with that of Professor Bell. The American Cushman Telephone Company was incorporated a short time ago. The company at once set out to manufacture and sell telephones. Immediately the Bell Company filed a bill in the Circuit Court praying for an injunction. To this bill an answer will be filed in a few days by Judge Smith, solicitor for the defendants. The answer denies that Bell had ever transmitted articulate speech by the method or with the apparatus now claimed to be covered by his patent. In 1851, the defendants claim, S. D. Cushman constructed and exhibited in Racine an instrument by which articulate sounds were transmitted in exactly the manner in which Bell accomplished the same thing years later. For three years Cushman's telephones were in public use in Racine, while the inventor endeavored to invent a transmitter which would so magnify the sounds that conversations could be carried on in noisy places. In 1867 and 1868 Cushman claims to have explained in public his method at Latonir, Malvern, New Lisbon and other places in Ohio.

BOSTON, Sept. 16, 1886.

Editors Electrical Review:

DEAR SIRS: An inaccuracy crept into your report of my remarks upon Mr. Hickley's paper read at the convention at Detroit. It occurs on page 6 of your issue of Sept. 11. The paragraph should read: "With regard to the statement made by the gentleman that one Watt per candle-power lamp is a monstrosity of electrical efficiency, and I should rather see the lamp than dispute the gentleman's statement. Yours truly,

M. M. M. SLATTERY.

—— At New York, an attachment has been issued against the property of the Standard Electric Light Company, in the suit brought by George Clark, of Springfield, Otsego county, N. Y., on the allegation that the company intends to dispose of its property to defraud its creditors.

—— The *Mail* says, apropos of the different channels, which open to growing humanity, that Mr. E. B. Chandler, former superintendent the Fire Alarm Department of Chicogo, and now general western agent for the Gamewell Fire Alarm Telegraph Company, and General Manager Marvin Hughitt, of the Northwestern Railway system, were once operators in the same telegraph office. Mr. Hughitt accepted an offer from the Illinois Central Company, became a train dispatcher, and once in the line of promotion, rapidly rose to the position of general superintendent. His advice to all his old chums was, "catch on. If you only take up train dispatching it will only be a question of time when you will get something better." Chandler tried it for a time, but he had a nervous presentment, and was in constant terror of running two trains together, and he says his hair would have turned gray years ago if he had kept at it. He says: "Every train dispatcher gets two trains started toward each other on the same track sooner or later, and while he may be able to prevent the collision every time but one, that one will come. I want none of that kind of responsibility."

The same writer says: "I saw Prof. Barrett, the present superintendent of the fire alarm system, on LaSalle street one afternoon last week, watching a gang of men lowering one of the huge poles on which the web of Western Union telegraph wires was formerly carried. "When I first began to urge the removal of these poles, eight or ten years ago," he said, "everybody laughed at me, and those who thought they knew most told me that I would be under ground a long time before those wires were. Now, there goes about the last of the poles. Pretty nearly all the wires are under ground, and working well, while I'm not buried yet and don't expect to be for a good many years."

—— Poughkeepsie claims to be the best lighted city of its size in America.—*Kingston Leader.* The claim is more than that. Poughkeepsie is the best lighted city of any size in America. And its death rate is among the lowest. Earthquakes do not disturb us. We have the best and most schools. Also one of the largest opera houses in the country. Likewise a champion ball club. And we are soon to show one of the greatest bridges on this part of the footstool.—*Poughkeepsie Journal.*

—— Corporation Counsel Lacomb on Friday rendered his opinion to the police commissioners as to their power to arrest agents of the Western Union Telegraph Company who may hereafter attempt to string that corporation's wires over the surface of the ground, on elevated railroad structures or elsewhere. He holds that it is within the power and duty of the police department to instruct the members of the force to arrest, without warrant, any person who may undertake to place telegraph, telephone and electric light wires and cables above the surface of the streets, lanes and avenues of the city.

—— The lighting of the Reading Room of the British Museum by electricity for the autumn and winter season commences today, when the closing hour for readers will be extended to 8 P. M. Mr. Barrett, the electrical engineer of the establishment, has been able to make considerable improvements on the lighting of previous years. It has been found that, from the great height of the dome, and the large circumference of the room, four lights are not sufficient, and it has been considered necessary to add a fifth. Additional lights have also been placed in several of the galleries, and in the new or "White" newspaper reading-room, and the number of incandescent lamps throughout the building has been largely increased.

——Another inventor of the process for obtaining light by the incandescence of a strip or wire of carbon was a young American, in England, forty years ago, Mr. Starr, whose patent for it (taken out by Mr. King) was enrolled on May 4, 1846. At the end of a barometer tube a bulb was blown, into which a platinum wire was fused and to one end of this a stick of gas retort carbon was fastened, the other wire being carried through the mercury, the whole tube being thirty-three inches long. Mr. Starr tried platinum and platino-iridium alloys, in wires and sheets, carbonized threads, cane, etc., before he hit upon gas-retort carbon. The lamp was repeateuly exhibited in action, at the town hall and the Midland Institute in Birmingham.—*Science.*

—— A gas company has asked leave to set posts on the streets of a neighboring city to hold electric light wires. What's up?—*Transcript.*

The wires and the price of gas. Ask another.

—— The Minnesota Brush Electric Company, which furnishes the incandescent lights for the art gallery in the new exposition building at Minneapolis, has one of the most interesting displays in the building. Their plant consists of three dynamos, each of sufficient capacity to run 300 Swan lamps of 16 candle-power each. Two of these dynamos are run by an Ide engine, on the first floor, near the main entrance. There are about 900 incandescent lights supplied by these dynamos, which are consequently run at nearly their full capacity. In addition to the art gallery, the exhibit of Janney, Semple & Co., the goddess of liberty, the model flour mill, and the *Tribune* exhibit are illuminated by Swan lamps. In the latter department a cluster of lamps shed a beautiful white light about and handsomely illuminate the apartment.

—— A new art has made its appearance, and will, no doubt, find a wide application in electricity and mechanics. The great benefits derivable from a method by which a practically continuous wire of any desired length may be obtained are especially of value to electrical constructors. Those engaged in the manufacture of dynamos know how troublesome the enlargement caused by the splice in a wire is. In the winding of field magnets the thickening of the wire at such points is a nuisance, and the projections frequently break through the insulation, and finally develop into serious faults. With the aid of the new art it seems possible to join two wires so that the point of juncture is practically identical in size and texture with the remaining part. A remarkable fact in connection with this process is the readiness with which metals of different character can be made to weld. It would almost seem that the metals, when put in the "electrotonic" state by the passage of a current, are endowed with peculiar propensities for welding. It follows, then, that large pieces requiring to be welded would be benefited by having an electric current passed through them, even though the current alone would not be sufficient to generate a welding heat. Such is the experience of Mr. Elihu Thomson, the inventor of this process. It is quite within probability, therefore, that every large forging or rolling mill establishment will in the future be equipped with powerful dynamos for the purpose of generating currents to be sent through the metal during its process of manufacture.

—— A special meeting of the stockholders of the United States Electric Lighting Company, of Washington, D. C., was held last week to take action relative to the establishment of a permanent central station to supply the increasing demand for arc and incandescent light. Dr. Z. T. Sowers was elected chairman, and B. G. Pool secretary.

Samuel Norment, esq., president of the company, referred to the progress made by the company since its organization and the opportunities afforded to do business in the coming future, urging that the company should now provide means and facilities for supplying the increasing demand for light. The general manager, secretary and treasurer submitted reports of the operations and financial condition of the company, showing that its earnings on the investment already made justified a yearly dividend of 6 per cent, payable quarterly.

A committee was appointed to submit to the stockholders at a future meeting, a plan for the construction of a permanent central station in a suitable locality, with improved machinery, to provide for the wants of the government and the general public in furnishing arc and incandescent light. Messrs. Charles S. Bradley, S. W. Tullock, Frank B. Conger, J. L. Hodge and C. S. Ramsburg were appointed as the committee. It is preferred to locate a permanent station, centrally located, with facilities in steam and electrical machinery, to supply 1,000 lights, to meet the requirements of the government and the business public.

ELECTRIC LIGHT NEWS

—— The Westinghouse Illuminating Company, of Schenectady, has already taken subscriptions for lights far in excess of its present capacity, and will at once increase to 2,000 lights.

—— The directors of the Laconia Electric Light Company have voted to lease their entire plant to Wm. C. Marshall, of the Belknap Mills, for a term of three years at 6 per cent. of the capital stock. The change is to date from September 1.

—— The Westinghouse Electric Company are fitting up a mammoth test room at their Pittsburgh manufactory. A 200 horse-power Westinghouse engine will be used for testing dynamos alone, besides a 75 horse-power in the shops, and 75 horse-power operating a 3 mile circuit on their high tension incandescent system.

—— Mr. Henry W. Pope, of 55 Broadway, is constructing, under contract with the Cohoes Gas Light Company, of Cohoes, N. Y., a plant of 180 lights of Thomson-Houston system. Mr. Pope is also to erect a plant, arc and incandescent, at Carbondale, Pa., and Morristown, N. J., and has contracted to equip a new street railway at Orange, N. J., with engines, boilers and electric motors.

—— The Merchant's Electric Light Company, Boston, have ordered a 125 horse-power Armington & Sims Co. engine. The power from this engine will be transmitted over wires to run Sprague motors all over the North End of Boston. It will furnish power for printing presses, sewing machines, ventilators, fans, and both freight and passenger elevators. By the means of this most wonderful system, attics and lofts can be made as valuable as lower floors. It is only a question of time when thousands of horse-power will be used in this city and all transmitted over a wire.

—— Messrs. Asa Cushman & Co., Shoe Manufacturers, Auburn, Me., have decided to light up their factory with the Thomson-Houston Company's incandescent lamps. They have ordered a new steel boiler and will set it with the Jarvis patent boiler setting, using the Sheffield grates. They have also ordered a 70 horse-power Armington & Sims Company's engine. The entire contract for this steam plant has been awarded to the Jarvis Engineering Company of Boston.

—— We understand that in England a new form of carbons has been brought out for arc lighting. These are held to give a higher efficiency than the ordinary cylindrical pencils now used, and to be especially applicable to the electric illumination of lighthouses. The carbons are fluted down the sides, but are made in molds and baked, much in the same way as ordinary cylindrical carbons. The greater efficiency is mainly due to the fact that the new carbons do not "crater" at the points, and hence there is not the same loss of light from that cause as occurs in the round carbons. Many experiments have been made with them with fair results. We shall watch further trials.

—— A company is being formed in Pittsfield, Mass., to put incandescent electric lights into the stores, and a good many merchants have subscribed for them. The present Pittsfield Electric Light Company, who control the arc light plant, are talking of adding several incandescent lights of the Thomson-Houston patent and also new facilities to their present plant. The satinet mill of the Pomeroy Company is to be equipped with about 100 incandescents lights, as their mill there has to be run night and day to supply the lower mill, and Tillotson & Power are going to have 250 in their woolen mill on the Barkerville road. Some of the other manufacturers in the town are talking of equipping their mills.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING SEPT. 14, 1886.

348,875 Switch socket for incandescent lamps; Merle J. Wightman and Hermann Lemp, Hartford, Conn., assignors to the Schuyler Electric Light Company.
348,876 Electric current regulator; Merle J. Wightman, Hartford, Conn, assignor to the Schuyler Electric Light Company.
348,880 Insulating conduit; Wm. W. Averell, Washington, D. C.
348,883 Armature for dynamo-electric machines; August Bossard, New York, N. Y.
348,901 Galvanic battery; Wm. C. Goldner, Boston, Mass., assignor to the Chemical Electric Light and Power Company, Portland, Me.
348,927 Electric arc lamp; Gustav Pfannkuche, Hartford, Conn., assignor to the Schuyler Electric Light Company, same place.
348,936 Telephone switch; Wm. C. Turnbull, Baltimore, Md.
348,949 Electric time ball; John Bohling, Washington, D. C.
348,971 Electric lamp; Edward Heymann and Frank W. Heymann, Boston, Mass., assignors of one-half to John J. Clapp, same place.
348,972 Electric lamp; Edward Heymann and Frank W. Heymann, Boston, Mass., assignors of one-half to John J. Clapp, same place.
348,973 Electric lamp; Edward Heymann and Frank W. Heymann, Boston, Mass., assignors of one-half to John J. Clapp, same place.
348,977 Arc light regulator; Pierre O. Keilholtz, Baltimore, Md., assignor to J. Frank Morrison, same place.
348,978 Carbon holder for electric arc lamps; Pierre O. Keilholtz, Baltimore, Md., assignor to J. Frank Morrison, same place.
348,994 Insulating wire and conductor for electrical purposes; Truman J. Pearce and Melvin W. Beardsley, Oakland, assignors to the Paraffine Paint Company, San Francisco, Cal.
349,022 Telegraph wire and insulator fastening; John Wilson, New York, N. Y.
349,040 Railroad signal; William Hadden, Brooklyn, N. Y.
349,042 Telephone system; Cornelius Herz, Paris, France.
349,043 Telephone; Cornelius Herz, Paris, France.
349,059 Telegraph pole; Jason E. Lippincott, Cincinnati, Ohio.
349,130 Dynamometer; George Westinghouse, Jr., and Frank Moore, Pittsburgh, Pa.
349,314 Telegraph system; Moses G. Farmer, New York, N. Y.

Parties Intending to purchase Electric Lighting Machinery, should consult
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CARLISLE BUILDING, CINCINNATI, O.

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A. C. FOWLER, C.E., was Examiner in the U. S. Patent Office from 1880 to 1885, in the Interference and Electrical Divisions.

Inventors and Others
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FOR ELECTRICAL INVENTIONS
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Or which they desire TO PLACE, are requested to communicate, giving Full Particulars, with
GEORGE H. BENJAMIN,
Electrical Engineer and Expert in Patent Causes,
No. 35 WALL STREET, NEW YORK.

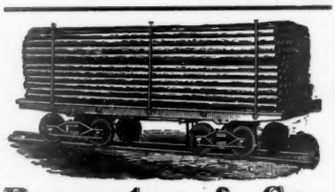
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Fig.259
PHOENIX GLASS COMPANY,
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Fig.255
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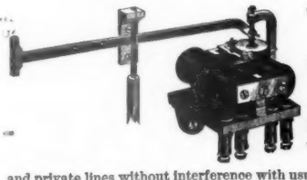

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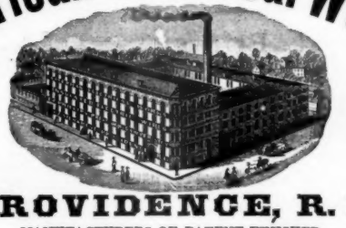

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By the use of our Electric Valve Service, the heating of buildings to a uniform temperature is accomplished. Rooms may be kept at any temperature desired, thereby saving fuel, discomfort, ill health, the cracking of wood-work, furniture and pictures, and the danger of fire by over heating. This apparatus applies equally well to all forms of heating and ventilating devices, the thermometer in the room automatically governing the temperature. It is invaluable in Public Buildings, Private Residences, Business offices, Hospitals, Churches, Schools, Conservatories, Factories, etc.

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NATIONAL ELECTRIC SERVICE CO.

NEW YORK, 686 Broadway. CHICAGO, 195 Wabash Avenue. BOSTON, 611 Washington street.

THE

American Bell Telephone Company,

95 MILK ST., BOSTON, MASS.

This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30, 1877, No. 186,787.

The Transmission of Speech by all known forms of ELECTRIC SPEAKING TELEPHONES infringes the right secured to this Company by the above patents, and renders each individual user of telephones, not furnished by it or its licensees, responsible for such unlawful use, and all the consequences thereof and liable to suit therefor.

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A Ten Conductor Cable at 6½ cents per foot.

The Conductors are No. 16 B. W. gauge copper tinned wire, 7 3-2 rubber insulation.

I have also a large lot of single conductor wire of different sizes which I am selling for less than the market price and will send my list of prices on application.

Samples of the cable and wire will be sent if desired.

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We Have Perfectly Adapted These Pencils to All the Prominent Systems in use.

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Pennsylvania R. R. Ferry,
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Tribune Building,
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Estimates made by Experts at short notice, on application at the office of the Company.

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SELF-OILING
Automatic Steam
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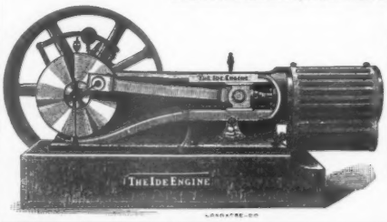

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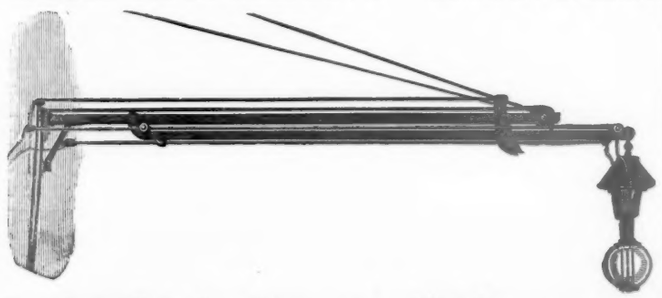

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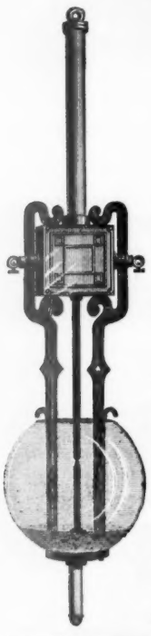
AGENCIES EVERYWHERE. **CLEVELAND, OHIO, U. S. A.**



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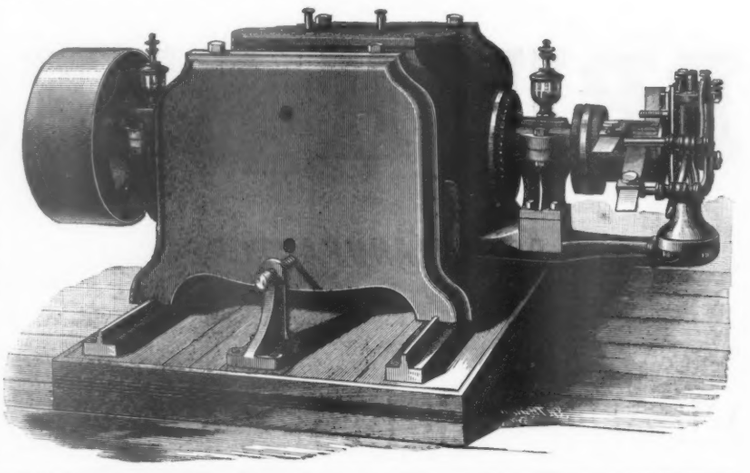

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In all desirable qualities of Electric Arc-Lights, the Thomson-Houston System has no equal. The Lights are *superior in color and steadiness*, and the entire apparatus is more *economical, efficient* and *safe*, more *easily managed*, and *less liable to derangement* than any other.

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was awarded the First Prize for the *best system* of Arc-Lighting, and the *best Arc Lamp*, at the Cincinnati Industrial Exposition of 1883.

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The most perfect system of both Incandescent and Arc Lighting. Entire freedom from hissing and flickering in our Arc Lights, and long life and great brilliancy in our Incandescent Lights.

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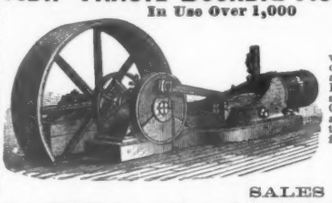
25 to 1,000 H. P.



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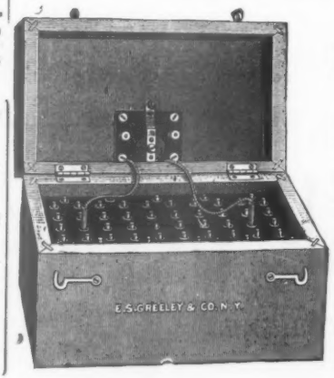

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In Polished Mahogany Case with Current Reverser.

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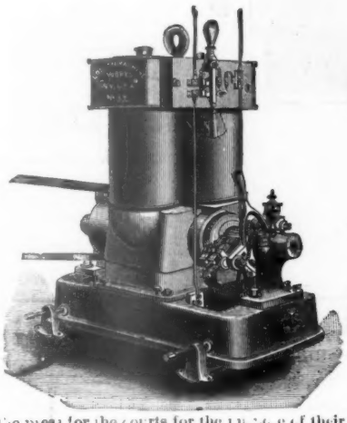

Estimates for Central Station or Isolated Plants furnished on application.

EDISON COMPANY, for ISOLATED LIGHTING,

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The Incandescent Electric Lamp is the universally acknowledged invention of Thomas Alva Edison, and is covered by fundamental patents granted to him January 27, 1880, No. 223,898; May 4, 1880, No. 227,229; and July 20, 1880, No. 230,255.

These patents, as well as some 300 additional detail and system patents, are all owned by this company.

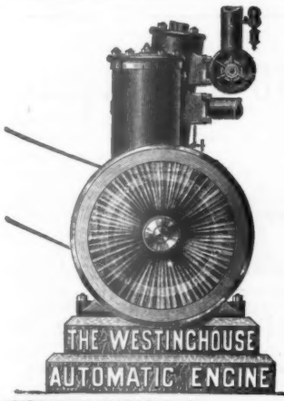
All forms of incandescent lamps as well as a great majority of the "Detail" and "System" devices offered by others than this company and its licensees, infringe the above mentioned patents, and all persons using them render themselves individually responsible for such unlawful use, and all the consequences thereof, and liable to suit therefor.

A CARD TO THE PUBLIC.

The Edison Electric Light Company having instituted suits on its patents, must decline to substitute the advertising columns of the press for the courts for the purpose of their legal interpretation. Mr. Edison's carbon filament patent of 1879 covers broadly the modern incandescent lamp. The claim that this patent has ever been in litigation in the United States Patent Office is absolutely false. In Germany and England, this fundamental patent has finally prevailed against all infringers thus establishing the fact that Mr. Edison's great invention has been nowhere anticipated; *Ergo*, a like result must follow in the United States. The straining and distorting of these facts, together with the violent effort to interweave with them certain minor and IRRELEVANT CASES for the purpose of fraudulently posing before the public as joint heirs with Mr. Edison in the fruits of these patent decisions, only indicate the DIRE EXTREMITY of those who are thus gradually becoming ENVIRONED by due process of law.

THE EDISON ELECTRIC LIGHT COMPANY

By EDWARD H. JOHNSON, Vice-President.



DURING THE PAST YEAR this Company has succeeded, through the medium of Special Machinery and Improved Methods, in bringing its output up to **3,500 H. P. per month,** while steadily Reducing the Cost of Production. At the same time the Materials and Workmanship have been Greatly Improved, as always follows from Systematic Manufacture. It has become possible therefore to carry out a long Determined Policy, and announce a

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TO WHICH BIDS ALREADY OUT WILL BE MADE TO CONFORM.

All Engines have Our Latest Improvements: Forged Steel Rods, Oil Separators, Back Pressure Balanced Valves, &c.

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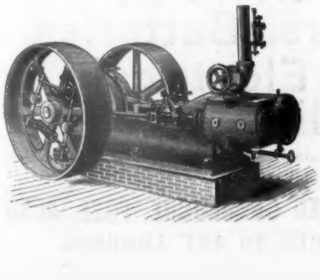

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For all Electrical Purposes. In Sheets, Rods, Tubes, and special designs as ordered when practicable. Rubber Hook Insulators, Window Tubes with Heads, Key Knobs, Switch Handles, Plug Handles, Battery Cells, Battery Syringes, Electric Lamp Switch Handles, &c., &c. Manufactured by

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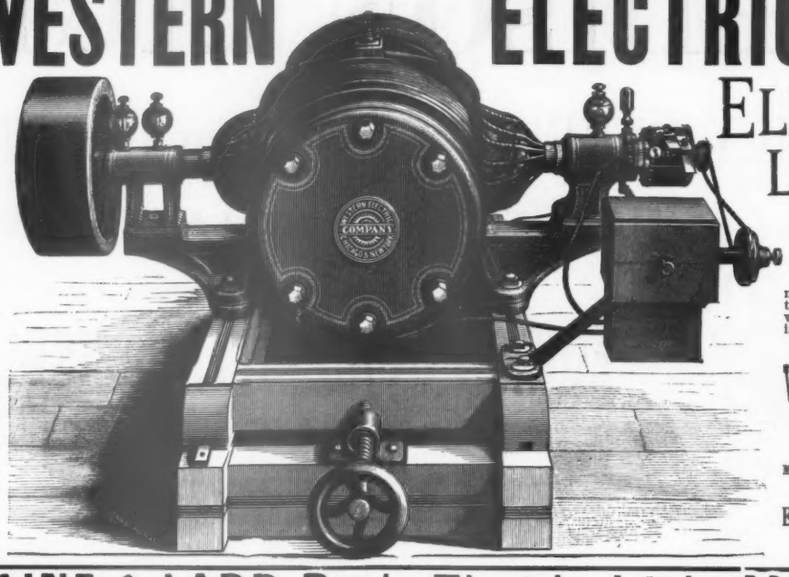

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T. H. BRADY, Patentee and Sole Manufacturer
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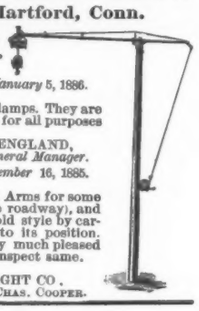

NEW YORK, *January* 5, 1886.
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Dear Sir.—I am much pleased with your Mast Arms for arc lamps. They are simple in construction, low in price, and perfectly adapted for all purposes where projecting lamps are required. Yours truly,
THE BRUSH-SWAN ELECTRIC LIGHT CO. OF NEW ENGLAND,
J. B. POWELL, *General Manager*.
BROOKLYN, NEW YORK, *December* 16, 1885.
MR. THOS. H. BRADY
Dear Sir.—Some few months ago we substituted your Mast Arms for some swinging lamps (i. e., lamps suspended in the middle of the roadway), and find them a vast improvement. We were troubled with the old style by carbons slipping by when the trimmer was pulling lamp out to its position. We find no such trouble with your Mast Arms, and are very much pleased with same. Should be pleased to have you send anyone to inspect same.
Respectfully,
MUNICIPAL ELECTRIC LIGHT CO.
CHAS. COOPER.

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Guaranteed to give satisfactory services under ground and over head. Specially adapted for Chemical Works, Paper Mills, Dye Works, Coal Mines, etc., etc.
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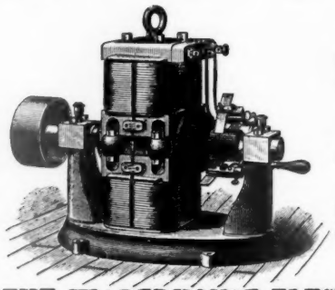

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OF THE
WATERHOUSE SYSTEM,
RESULTED VIZ:
46 Lights on 7 mile circuit, current 9.44 amperes (Ayrton & Perry standard.) Power Required, 26.62 H.P., or .58 H.P. per light.
A 50 H. P. Engine, same as is furnished to run 50 full arc lights of other systems, will operate at its MOST ECONOMICAL POINT of cut-off
90 FULL ARC WATERHOUSE LIGHTS.
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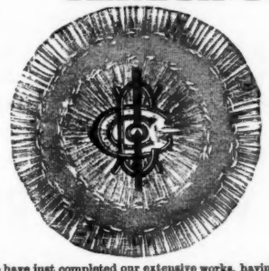

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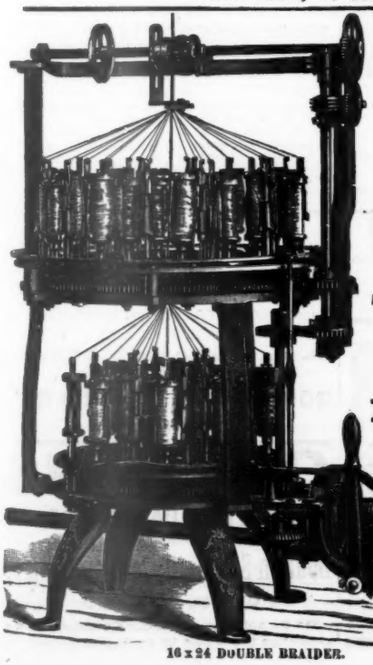

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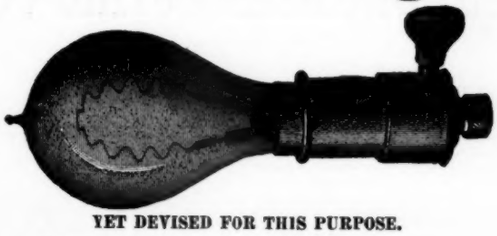

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